Verde Watershed

VERDE WATERSHED CHARACTERISTICS

SIZE	6,624 square miles (6% of the state's land area).					
POPULATION BASE	Approximately 153,000 people live in this watershed (estimated from the 2000 census). This is about 3% of the state's population.					
LAND OWNERSHIP **(Figure 57)**	U.S. Forest Service	64%	State Land Dept.	10%	Other state and federal	1%
	Private	23%	Tribal land	2%		
LAND USES AND PERMITS **(Figure 58)**	This watershed includes Payson, the Sedona-Cottonwood-Verde Valley area, the majority of Prescott and the southern outskirts of Flagstaff. Primary land uses are grazing, irrigated agriculture, recreation, with some mining and silviculture.					
HYDROLOGY AND GEOLOGY	This watershed is defined by the Verde River drainage area. The Verde River and many of its tributaries are perennial (Brown et al., 1978). Flows from the Verde River are regulated at two reservoirs -- Horseshoe Lake and Bartlett Lake. Flow above Horseshoe Reservoir on the Verde River varies from 48 cfs (1956) to 145,000 cfs (1993), and the annual mean flow since 1946 has been 599 cfs (USGS, 1996). The Mogollon Rim escarpment forms a topographic relief of as much as 2,000 feet and trends northwest across the watershed, dividing the watershed between two Hydrologic Provinces: Central Highlands (southern half), Plateau Uplands (northern half). Elevation ranges from more than 12,000 feet in the San Francisco Mountains to about 1,600 feet in the south. This watershed includes two ground water basins and portions of two active management areas: Verde River, Peach Springs, the northeast half of the Prescott AMA, and a small portion of the Phoenix AMA. Principal aquifers occur in three areas: basin-fill sediment and alluvium (i.e., sands, gravels, clays, conglomerate) interbedded with basalt flows; a shallow alluvial aquifer within the flood plain of the Verde River; and a sequence of limestones and sandstones, typical of the Verde Valley area (ADWR 1994).					
UNIQUE WATERS	Oak Creek and West Fork of Oak Creek					
ECOREGIONS	Arizona-New Mexico Mountains, except the southern tip that is in the Southern Basin and Range.					
OTHER STATES, NATIONS, OR TRIBES	Camp Verde, Tonto Apache, Yavapai-Prescott, and Fort McDowell tribes are stakeholders in this watershed.					

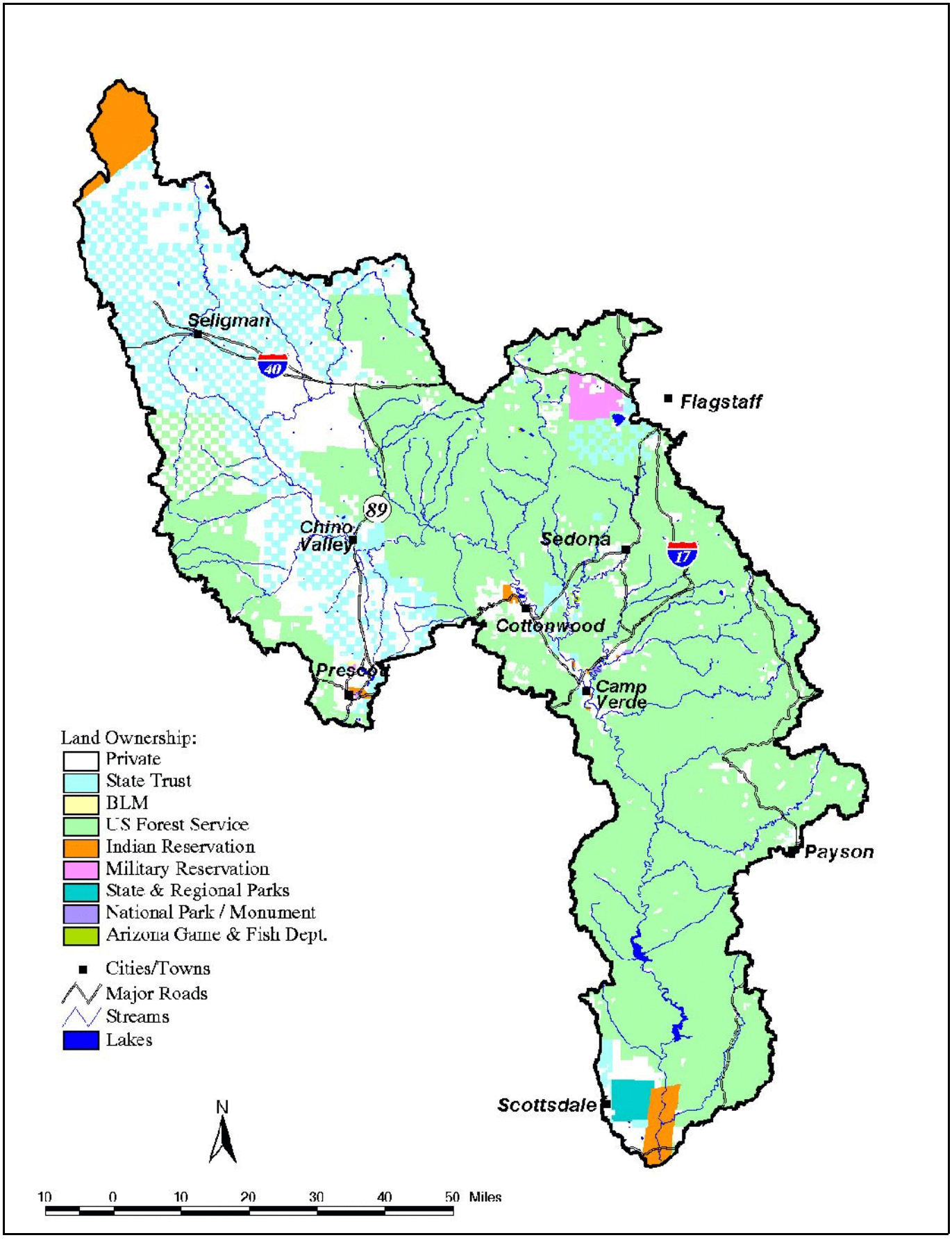

Figure 57. Land Ownership in the Verde Watershed

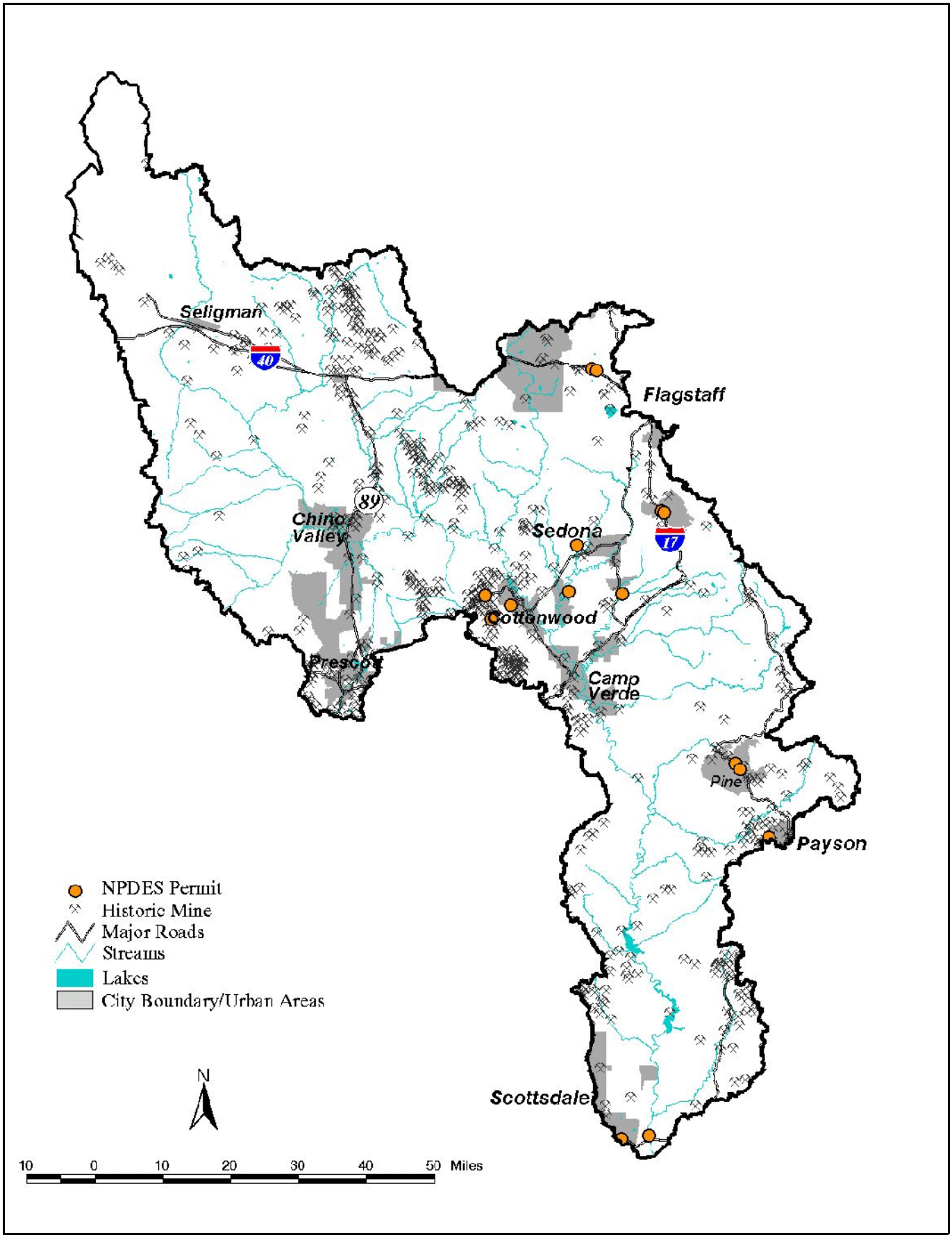

Figure 58. General Land Use and NPDES Permits in the Verde Watershed

Verde Watershed Assessment Discussion

Statistical Summary of Surface Water Assessments

Assessments – For the 2002 assessment, 493 stream miles and 4,674 lake acres were assessed. This assessment reflects data collected in 1999 when this was the focus watershed for monitoring.

Water quality assessment information for the Verde Watershed is summarized in the following tables and illustrated in **Figure 59**.

Table 30. Assessments in the Verde Watershed – 2002

	STREAMS		LAKES	
	miles	number of segments	acres	number of lakes
ATTAINING	234	14	2,459	5
INCONCLUSIVE	224	18	1995	2
IMPAIRED	34	2	0	0
NOT ATTAINING	1	1	220	2
TOTAL ASSESSED	493	35	4,674	9

PERENNIAL SURFACE WATERS ASSESSED		STREAMS		LAKES	
		miles	number of segments	acres	number of lakes
	Assessed	401	27	4,674	9

* Note that streams with significant perennial stretches within the reach assessed were included in the perennial milage although part of the reach may have ephemeral or intermittent flow.

Inconclusive Assessments – Surface waters with some monitoring data, but insufficient data to determine if a designated use is attaining or impaired, were added to the new Planning List. During the next watershed monitoring cycle (scheduled in 2004), ADEQ expects to monitor most of these reaches and lakes so that all designated uses can be assessed during the following assessment cycle. Other lakes and streams which lack monitoring data will also be monitored depending on resources and priorities.

ADEQ will be working with US Geological Survey and the Arizona Game and Fish Department, so that their future monitoring efforts will better support Arizona's surface water assessments.

Major Stressors – When a surface water is listed as impaired or not attaining a designated use, the pollutants or suspected pollutants causing the impairment are identified. In this watershed, two reaches were assessed as impaired due to turbidity: Beaver Creek and Oak Creek.

Nutrient TMDLs were completed and approved by EPA at two lakes, Peck's Lake and Stoneman Lake to mitigate high pH and low dissolved oxygen levels. A TMDL was also completed for Oak Creek at Slide Rock State Park due to bacterial violations and subsequent swimming area closures. These two lakes and one reach were assessed as "not attaining," and were placed on the Planning List. They will be monitoring to evaluate the effectiveness of TMDL implementation strategies.

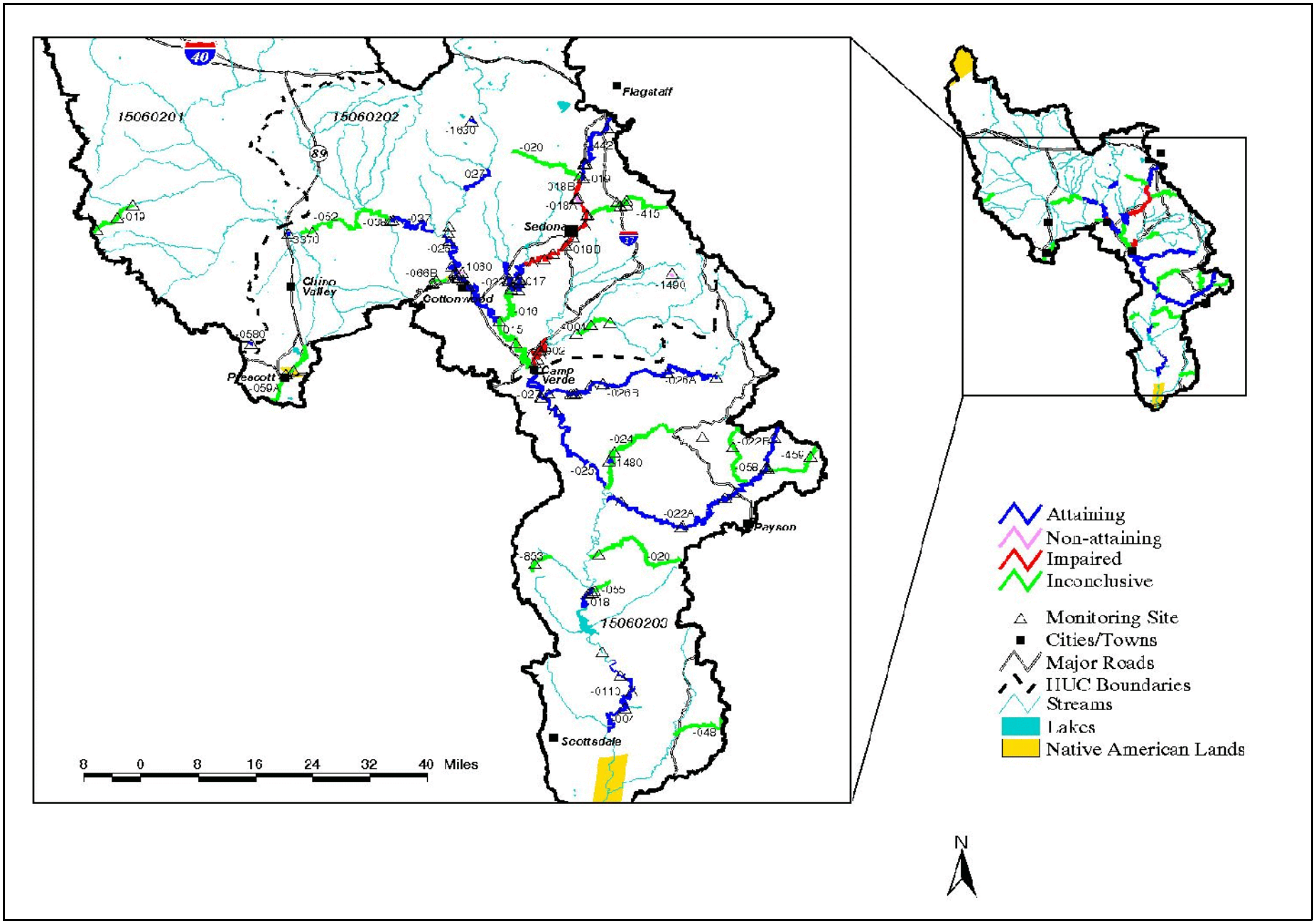

Figure 59. Verde Watershed Surface Water Quality Assessments – 2002

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
STREAM MONITORING DATA								
Apache Creek headwaters-Walnut Creek AZ15060201-019 A&Ww, FC, FBC, AgL	ADEQ Stream Ecosystem Monitoring Near Walnut Creek VRAPA000.1 100189	1997 - 1 suite	OK					
	ADEQ Biocriteria Program Above Hunt Tank VRAPA002.46 100715	1996 - 1 suite	OK					
	ADEQ Stream Ecosystem Monitoring Below Apache Springs VRAPA005.2 100190	1997 - 1 suite	OK					
	Reach Summary Row **A&Ww Inconclusive** **FC Inconclusive** **FBC Inconclusive** **AgL Inconclusive**	**1996-1997** **3 samples** **2 sampling events**	**OK**				**Inconclusive**	**ADEQ collected a total of 3 samples from 3 sites in 1996-1997. This intermittent stream is assessed as "inconclusive" due to insufficient sampling events.**
Beaver Creek Dry Beaver Ck.-Verde River AZ15060202-002 A&Wc, FC, FBC, AgL	ADEQ Ambient Monitoring Montezuma's Castle VRBEV002.62 100706	1999 - 1 suite	OK					No bacteria samples.
	ADEQ TMDL Montezuma's Castle VRBEV002.44	1999 - 3 field, nutrients, turbidity 2000 - 2 field, nutrients, turbidity	Turbidity NTU	10 (A&Wc)	2-218	2 of 6		Missing core parameters: bacteria.
	ADEQ Fixed Station Network/TMDL at Camp Verde VRBEV003.64 100496	1997 - 3 field, 1 nutrient 1998 - 4 field 1999 - 1 suite + 4 field 2000 - 2 field, nutrients	Dissolved oxygen mg/l	7.0 (90% saturation) (A&Wc)	5-10.7 (66-104%)	3 of 9		Staff documented that low dissolved oxygen was due to ground water upwelling that is naturally low in dissolved oxygen; therefore, not considered in the final assessment. Missing core parameters: bacteria.
			Turbidity NTU	10 (A&Wc)	12-290	5 of 7		
	ADEQ Ambient Monitoring Above Verde River VRBEV000.62 100722	1999 - 1 suite	Turbidity NTU	10 (A&Wc)	28	1 of 1		Missing core parameters: bacteria.

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ TMDL Monitoring at Silt001	1999 - 1 field 2000 - 2 field, nutrients	Turbidity	10 (A&Wc)	2-190	1 of 3		Missing core parameters: bacteria
	ADEQ TMDL Monitoring at Foam0001	2000 - 2 field, nutrients	OK					Missing core parameters: bacteria
	ADEQ TMDL Monitoring Eureka Ditch	1999 - 1 field, nutrients 2000 - 2 field, nutrients (no bacterial samples)	Turbidity NTU	10 (A&Wc)	30-101	3 of 3		Missing core parameters: bacteria
	ADEQ Biocriteria Program Above Verde River VRWBV000.58 100496	1997 - 4 field + nutrients 1998 - 1 field + nutrients + 2 field	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	5.2-9.15 (70-97%)	2 of 7		Missing most core parameters.
	ADEQ TMDL Monitoring above irrigation return	1999 - 1 suite 2000 - 2 field, nutrients (no bacterial samples)	Dissolved oxygen mg/l	7 90% Saturation (A&Wc)	6.6-8.1 71-104%)	1 of 4		Missing core parameters: bacteria
			Turbidity NTU	10 (A&Wc)	1-33	1 of 4		
	Reach Summary Row **A&Wc Impaired** **FC Attaining** **FBC Inconclusive** **AgL Attaining**	**1997-2000** **33 samples** **20 sampling events** **Missing core parameters**	**Dissolved oxygen mg/l**	**7 90% Saturation (A&Wc)**	**5-8.1 (66.6-104%)**	**3 of 33**	**Attaining**	**ADEQ collected a total of 26 samples at 9 sites from 1997-2000. Reach assessed as "impaired" due to turbidity. Add to Planning List due to missing core parameters.**
			Turbidity NTU	**10 (A&Wc)**	**20-290**	**13 of 33**	**Impaired**	
Bitter Creek 2.5 miles below WWTP-Verde AZ15060202-066C A&Ww, FC, PBC, AgL	ADEQ Stream Ecosystem Monitoring At confluence with Verde River VRBIT000.1 100191	1997 - 1 suite	OK					
	Reach Summary Row	**1997** **1 sampling event**					**Not assessed**	**Insufficient to data to assess.**
Bitter Creek WWTP- 2.5 miles below WWTP AZ15060202-066B A&Wedw, PBC	ADEQ Biocriteria Program 0.5 miles below Jerome WWTP VRBIT002.64 100424	1996 -1 suite	OK					

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT								
STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	**AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID**	**YEAR SAMPLED NUMBER AND TYPE OF SAMPLES**	**STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT**					
			PARAMETER UNITS	**STANDARD (DESIGNATED USE)**	**RANGE OF RESULTS (MEAN)**	**FREQUENCY EXCEEDED STANDARD**	**DESIGNATED USE SUPPORT**	**COMMENTS**
	ADEQ Stream Ecosystem Monitoring At pet cemetery VRBIT003.1 100192	1997 - 1 suite	OK					
	ADEQ Stream Ecosystem Monitoring Below Jerome WWTP VRBIT002.72 100193	1997 - 1 suite	OK					
	Reach Summary Row A&Wedw Inconclusive PBC Inconclusive	**1996-1997 3 samples 2 sampling events**	**OK**				**Inconclusive**	**ADEQ collected a total of 3 samples at 3 sites. Reach assessed as "inconclusive" due to insufficient sampling events.**
(Unnamed trib.) to Bitter Creek headwaters-Bitter Creek AZ15060202-868 A&Ww, FC, PBC, AgL	ADEQ Ambient and Biocriteria Unnamed tributary off of Bitter Creek VRUBT000.3 100221	1997- 1 suite	OK					
	Reach Summary Row	**1997 1 sampling event**	**OK**				**Not assessed**	**Insufficient to data to assess.**
Black Canyon Creek AZ15060202-886 A&Ww, FC, FBC, AgL	ADEQ Biocriteria Program Below Gaddes Canyon VRBLA006.03 100418	1996 - 1 suite	OK					Insufficient to data to assess
	Reach Summary Row	**1996 1 sampling event**	**OK**				**Not assessed**	**Insufficient to data to assess.**
Camp Creek headwaters-Verde River AZ15060203-031 A&Ww, FC, FBC, DWS, AgI, AgL	ADEQ Biocriteria Program Above Blue Wash confluence VRCMP009.30 100760	1998 - 1 suite	OK					
	Reach Summary Row	**1998 1 sampling events**	**OK**				**Not assessed**	**Insufficient to data to assess.**
East Verde River headwaters-American Gulch AZ15060203-022A A&Wc, FC, FBC, DWS, AgI, AgL	ADEQ Biocriteria Program Above Brushy Canyon VREVR011.19 100549	1996 -1 suite	OK					

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ Fixed Station Network below Highway 87 bridge VREVR012.28 100474	1999 - 5 suites 2000 - 4 suites	Beryllium, (total) µg/L	0.21 (FC)	0.55 - 2.6	2 of 2		7 other beryllium samples did not have a low enough Laboratory Reporting Limit.
			Dissolved oxygen mg/L	7 (A&Wc)	6.5-11.0	1 of 9		
			Nitrogen (total) mg/L	3 (A&Wc)	0.07- 4.5	1 of 9		
			Phosphorus (total) mg/L	1 (A&Wc)	0.2-1.0	1 of 9		
			Turbidity NTU	10 (A&Wc)	3.07 - 1,000	5 of 9		
	ADEQ Biocriteria Program Below Ellison Creek VREVR015.85 100548	1996 - 1 suite	OK					
	ADEQ Fixed Station Monitoring Above Second Crossing VREVR015.97 100786	1999 - 2 suites	Turbidity NTU	10 (A&Wc)	23 - 53.6	2 of 2		
	ADEQ Biocriteria Program Below Washington Park VREVR018.56 100546	1996 - 1 suite	OK					
	Reach Summary Row **A&Wc Inconclusive** **FC Attaining** **FBC Attaining** **DWS Attaining** **AgI Attaining** **AgL Attaining**	**1996-2000** **14 samples** **12 sampling events**	**Beryllium (total) µg/L**	**0.21 (FC)**	**0.55 - 2.6**	**2 of 2**	**Attaining**	**ADEQ collected a total of 14 samples at 5 sites in 1996-2000. Reach assessed as "attaining some uses" and added to Planning List due to turbidity exceedances.**
			Dissolved oxygen mg/L	**7 (A&Wc)**	**6.5-11.0**	**1 of 13**	**Attaining**	
			Nitrogen (total) mg/l	**3 (A&Wc)**	**0.07- 4.5**	**1 of 11**	**Attaining**	
			Phosphorus	**1 (A&Wc)**	**0.2-1.0**	**1 of 11**	**Attaining**	
			Turbidity NTU	**10 (A&Wc)**	**3.07 - 1,000**	**7 of 14**	**Inconclusive**	
East Verde River American Gulch-Verde River AZ15060203-022B A&Wc, FC, FBC, DWS, AgI, AgL	USGS Station #09507980 Near Childs VREVR001.42 100739	1996 - 6 suites 1997 - 6 suites 1998 - 5 suites 1999 - 6 suites 2000 - 4 suites	Antimony (total) µg/L	6 (DWS)	1.0-49	4 of 26		Naturally high levels of antimony and arsenic in the ground water seeping into surface water when flow is below 5 cfs. Because exceedances are solely naturally occurring, they are not included in the final assessment.
			Arsenic (total) µg/L	50 (DWS)	4.0-170.0	5 of 26		

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
			Dissolved oxygen mg/L	>7 (A&Wc)	5.8-7.76	1 of 12		Staff documented that low dissolved oxygen was due to ground water upwelling that is naturally low in dissolved oxygen; therefore, not considered in the final assessment.
			Turbidity NTU	10 (A&Wc)	0.2-35	2 of 27		
	ADEQ Biocriteria Program Below Pine Creek VREVR008.23 100550	1996 - 1 suite	OK					
	Reach Summary Row **A&Ww Attaining** **FC Attaining** **FBC Attaining** **DWS Attaining** **AgI Attaining** **AgL Attaining**	**1996-2000** **28 sampling events**	**Turbidity NTU**	**10 (A&Wc)**	**0.2-35**	**2 of 27**	**Attaining**	**USGS collected 27 samples and ADEQ collected 1 sample in 1996-2000. See comment above concerning antimony and arsenic exceedances. Reach assessed as "attaining all uses."**
Ellison Creek headwaters-East Verde River AZ15060203-459 A&Wc, FC, FBC, AgL	ADEQ Biocriteria Program Above East Verde River VRELL000.12 100543	1996 - 1 suite	OK					Missing core parameters: bacteria
	ADEQ Biocriteria Program Headwaters VRELL004.47 100542	1996 - 1 suite	OK					Missing core parameters: bacteria
	Reach Summary Row **A&Ww Inconclusive** **FC Inconclusive** **FBC Inconclusive** **AgL Inconclusive**	**1996** **2 samples** **1 sampling event** **Missing core parameters**	**OK**				**Inconclusive**	**ADEQ collected a total of 2 samples at 3 sites in 1996-1997. Assessed as "inconclusive"and added to the Planning list due to lack of sampling events and missing bacteria**
Fossil Creek headwaters-Verde River AZ15060203-024 A&Ww, FC, FBC, AgL	ADEQ Fixed Station Network Above Salley Mae Wash VRFOS005.67 100785	1999 - 2 suites	OK					
	Reach Summary Row **A&Ww Inconclusive** **FC Inconclusive** **FBC Inconclusive** **AgL Inconclusive**	**1999** **2 sampling events**	**OK**				**Inconclusive**	**ADEQ collected 2 samples in 1999. Reach assessed as "inconclusive" and added to the Planning List due to lack of sampling events.**

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Granite Creek headwaters-15060202-060 AZ15060202-059 A&Ww, FC, FBC, AgI, AgL	USGS #09502960 VRGRA004.68	1996 - 1 suite 1999 - 2 suites 2000 - 2 suites	Escherichia coli CFU/100 ml	580 (FBC)	71-8000	1 of 3		Missing core parameters: turbidity, nutrients, many metals.
	ADEQ Fixed Station Network At Sundog Ranch Road VRGRA003.88 100489	1996 - 2 suites	Beryllium (total) µg/L	0.21 (FC)	0.6	1 of 1		One other beryllium sample did not have a low enough Laboratory Reporting limit.
			Escherichia coli CFU/100 ml	580 (FBC)	220-1266	1 of 2		
			Turbidity NTU	50 (A&Ww)	7.44-273	1 of 2		
	Reach Summary Row **A&Ww Inconclusive** **FC Inconclusive** **FBC Inconclusive** **AgI Inconclusive** **AgL Inconclusive**	**1996-2000** **7 sampling events** **Missing core parameters**	**Beryllium (total) µg/L**	**0.21 (FC)**	**0.6**	**1 of1**	**Inconclusive**	**ADEQ collected a total of 7 samples at 2 sites in 1996-2000. Reach assessed as 'inconclusive" and added to the Planning List due to Escherichia coli, beryllium, and turbidity exceedances and missing core parameters.**
			Escherichia coli CFU/100 ml	**580 (FBC)**	**220-1266**	**2 of 6 (exceedances occurred 5 years apart)**	**Inconclusive**	
			Turbidity NTU	**50 (A&Ww)**	**7.44-273**	**1 of 2**	**Inconclusive**	
Houston Creek headwater-Verde River AZ15060203-041 A&Ww, FC, FBC, AgL	ADEQ Biocriteria Program Above Forest Road #6 VRHOU002.75 100761	1996 - 1 suite	OK					No bacterial samples
	Reach Summary Row	**1996 1 sampling event**	**OK**				**Not assessed**	**Insufficient data to assess.**
Lime Creek headwaters-Horseshoe Res AZ15060203-030 A&Ww, FC, FBC, AgL	ADEQ Biocriteria Program 1 mile above Verde VRLIM000.71 100585	1996 - 1 suite	OK					No bacterial or nutrient samples
	Reach Summary Row	**1996 1 sampling event**	**OK**				**Not assessed**	**Insufficient data to assess.**
Munds Creek headwaters-Oak Creek AZ15060202-415 A&Ww, FC, FBC, DWS, AgI, AgL	ADEQ TMDL Program Above Oak Creek VRMUN000.1	1998 - 3 suites	OK					Missing core parameters: metals, boron. All samples in March, April, and May.
	ADEQ TMDL Program Below Pinewood WWTP VRMUN003.4	1998 - 3 suites	OK					
	ADEQ TMDL Program West tributary of Munds Creek Above Pinewood WWTP VRMUN003.5	1997 - 1 suite 1998 - 3 suites	Turbidity NTU	50 (A&Ww)	4-67	1 of 2		

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ TMDL Program Southeast trib to O'Dell Lake VRMUN004.1	1998 - 2 suites	OK					
	ADEQ TMDL Program Above O'Dell Lake VRMUN004.3	1998 - 3 suites	Turbidity NTU	50 (A&Ww)	5-69	1 of 2		
	Reach Summary Row **A&Ww Inconclusive** **FC Inconclusive** **FBC Inconclusive** **DWS Inconclusive** **AgL Inconclusive**	**1997-1998** **15 samples** **4 sampling events** **Missing core parameters and seasonal representation**	**Turbidity NTU**	**50 (A&Ww)**	**4-69**	**2 of 12**	**Attaining**	**ADEQ collected a total of 15 samples at 5 sites in 1997-1998. Reach is assessed as "inconclusive" and added to the Planning List due to lack of core parameters and seasonal representation.**
Oak Creek headwaters-West Fork Oak Cr. AZ15060202-019 A&Wc, FC, FBC, DWS, AgI, AgL Unique Waters	ADEQ Biocriteria Program Below Cave Springs VROAK023.21 100608	1996 - 1 suite 1998 - 1 suite	OK					No bacteria, beryllium, boron, or mercury. Only 1 cadmium, chromium, and lead, zinc, or fluoride. No mining in the drainage area; therefore, metal samples not required.
	ADEQ TMDL Program Below Pumphouse Wash VROAK025.2	1998 - 3 field + nutrients, bacteria	Turbidity NTU	10 (A&Wc)	1-20	1 of 3		
	ADEQ TMDL Program Above Pumphouse Wash VROAK025.3	1998 - 3 field, nutrients, bacteria	OK					
	AGFD Above Sterling Springs Hatchery	1996 - 1 field, nutrients, bacteria	OK					
	AGFD Below Sterling Springs Hatchery	1996 - 1 field, nutrients, bacteria	OK					
	Reach Summary Row **A&Ww Inconclusive** **FC Attaining** **FBC Attaining** **DWS Inconclusive** **AgI Inconclusive** **AgL Attaining**	**1996-1998** **9 samples** **5 sampling events** **Missing core parameters**	**Turbidity NTU**	**10 (A&Wc)**	**1-20**	**1 of 9**	**Inconclusive**	**ADEQ and AGFD collected a total of 9 samples at 5 sites in 1996-1998. Reach assessed as "attaining some uses" and added to the Planning List due to turbidity exceedance and missing core parameters (beryllium and boron).**
Oak Creek West Fork Oak Cr.-Dry Creek (except Slide Rock State Park) AZ15060202-018B A&Wc, FC, FBC, DWS, AgI, AgL Unique Water	ADEQ Fixed Station Network At Redrock Crossing VROAK009.33 100492	1996 - 5 suites 1997 - 4 suites 1998 - 4 suites 1999 - 5 suites 2000 - 4 suites	Beryllium (total) µg/L	4.0 (DWS, FBC)	4.1	1 of 20		
			Beryllium (total) µg/L	0.21 (FC)	4.1	1 of 1		Nineteen other beryllium samples did not have a low enough Laboratory Reporting Limit.

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT								
STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	**AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID**	**YEAR SAMPLED NUMBER AND TYPE OF SAMPLES**	**STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT**					
			PARAMETER UNITS	**STANDARD (DESIGNATED USE)**	**RANGE OF RESULTS (MEAN)**	**FREQUENCY EXCEEDED STANDARD**	**DESIGNATED USE SUPPORT**	**COMMENTS**
			Total Nitrogen mg/L	2.5 Unique Waters	0.08-5.0	1 of 21		
			Total Phosphorus mg/L	0.3 Unique Waters	< 0.1 - 1.5	1 of 21		
			Turbidity NTU	10 (A&Wc)	1-1000	3 of 22		
	ADEQ Biocriteria Program At Red Rock State Park VROAK010.29 100612	1996 - 1 suite 1999 - 1 suite	Turbidity NTU	10 (A&Wc)	6-15	1 of 2		
	ADEQ TMDL Program Below Redrock Crossing VROAK011.4	1998 - 3 field + nutrients	OK					
	ADEQ Ambient and Biocriteria At Chavez Crossing VROAK013.11 100461	1996 - 1 suite 1998 - 3 suites	Turbidity NTU	10 (A&Wc)	6-26	1 of 3		
	ADEQ Ambient and Biocriteria At Highway 179 bridge VROAK014.54 100460	1998 - 3 suites	Turbidity NTU	10 (A&Wc)	6-18	1 of 3		
	ADEQ Fixed Station Network below Grasshopper Point VROAK016.57 100459	1996 - 1 suite 1998 - 3 suites	Turbidity NTU	10 (A&Wc)	2-21	1 of 4		
	ADEQ TMDL Program Below Munds Creek VROAK018.1	1998 - 3 suites	Turbidity NTU	10 (A&Wc)	1-30	1 of 3		
	ADEQ TMDL Program Above Munds Creek VROAK018.3	1998 - 3 suites	Turbidity NTU	10 (A&Wc)	1-22	1 of 3		

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row **A&Wc Impaired** **FC Attaining** **FBC Attaining** **DWS Attaining** **AgI Attaining** **AgL Attaining**	**1996 - 2000** **44 samples** **25 sampling events**	**Beryllium (total) µg/L**	**4.0 (DWS, FBC)**	**< 0.5 - 4.1**	**1 of 27**	**Attaining**	**ADEQ collected a total of 44 samples from 8 sites in 1996-2000. The reach is assessed as" impaired" due to turbidity. (Note change in designated use in new rule package submitted to EPA would bring this reach into compliance with turbidity standard.)**
			Beryllium (total) µg/L	**0.21 (FC)**	**4.1**	**1 of 1**	**Attaining**	
			Total Nitrogen mg/L	**2.5 Unique Waters**	**0.08-5.0**	**1 of 43**	**Attaining**	
			Total Phosphorus mg/L	**0.3 Unique Waters**	**< 0.1 - 1.5**	**1 of 43**	**Attaining**	
			Turbidity NTU	**10 (A&Wc)**	**1-1000**	**9 of 42**	**Impaired**	
Oak Creek At Slide Rock State Park only AZ15060202-018A A&Wc, FC, FBC, DWS, AgI, AgL Unique Water	Slide Rock State Park Routine Bacterial Monitoring Upstream	1996 - 2000 839 *E. coli* samples only	Escherichia coli CFU/100 ml	580 (FBC)	1-2491	20 of 839		No mining in the drainage area: therefore, metal samples not required to assessed designated uses. Samples collected in surrounding reach contained the core parameters (see 15060202-018B).
	Slide Rock State Park Routine Bacterial Monitoring Mid-slide	1996 - 2000 778 *E. coli* samples only	Escherichia coli CFU/100 ml	580 (FBC)	1-2491	20 of 778		
	Slide Rock State Park Routine Bacterial Monitoring Large Pool	1996 - 2000 995 *E. coli* samples only	Escherichia coli CFU/100 ml	580 (FBC)	1-2491	16 of 995		
	ADEQ/TMDL Above Slide Rock Foot Bridge VROAK020.02	1998 -1 field (no bacteria)	OK					
	Slide Rock State Park Foot Bridge Routine Bacterial Monitoring	1996 - 2000 712 *E. coli* samples only	Escherichia coli CFU/100 ml	580 (FBC)	1-2491	21 of 712		
	Slide Rock State Park at Highway Bridge Routine Bacterial Monitoring	1996 - 2000 853 *E. coli* samples only	Escherichia coli CFU/100 ml	580 (FBC)	1-2491	22 of 853		
	EPA/ADEQ Biocriteria Program at Slide Rock State Park VROAK019.98 100609	1996 - 1 suite (no bacteria)	OK					
	ADEQ/TMDL Below Slide Rock VROAK020.0	1998 - 1 field (no bacteria)	OK					

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row **A&Wc Inconclusive** **FC Inconclusive** **FBC Not attaining** **DWS Inconclusive** **AgI Inconclusive** **AgL Inconclusive**	**1996-2000** **3 samples plus 4177 *E. coli* samples**	**Escherichia coli CFU/100 ml**	**580 (FBC)**	**1-2491**	**75 of 4177 (more than 2 exceedances in a 3-year period)**	**Not attaining**	**ADEQ collected 3 samples at 3 sites in 1996-1998. Slide Rock State Park collected a total of 4177 Escherichia coli samples at 5 sites in 1996-2000. EPA approved TMDLs for pathogens, total phosphorus and total nitrogen in 1999. Reach assessed as "not attaining" due to E. coli exceedances. Add to Planning List to determine the effectiveness of TMDL implementation strategies.**
Oak Creek Dry Creek-Spring Creek AZ15060202-017 A&Wc, FC, FBC, DWS, AgI, AgL Unique Waters	ADEQ Biocriteria Program Below Page Springs VROAK005.91 100613	1996 - 1 suite (few metals) 1999 - 1 suite	Turbidity NTU	10 (A&Wc)	4-15	1 of 2		
	ADEQ TMDL Program At Page Springs Bridge VROAK006.4	1998 - 1 field, nutrients and turbidity	Turbidity NTU	10 (A&Wc)	45	1 of 1		
	ADEQ Biocriteria Program Above Page Springs VROAK006.49 100614	1996 - 1 suite (few metals)	Turbidity NTU	10 (A&Wc)	1-25	1 of 1		
	Reach Summary Row **A&Wc Inconclusive** **FC Attaining** **FBC Inconclusive** **DWS Attaining** **AgI Inconclusive** **AgL Attaining**	**1996-1998** **4 samples** **3 sampling events** **Missing core parameters (bacteria and boron)**	**Turbidity NTU**	**10 (A&Wc)**	**1-25**	**3 of 4**	**Inconclusive**	**ADEQ collected a total of 4 samples at 3 sites in 1996-1998. Reach assessed as "attaining some uses" and added to the Planning List due to turbidity exceedances and lack of core parameters.**
Oak Creek Spring Creek-Verde River AZ15060202-016 A&Wc, FC, FBC, DWS, AgI, AgL Unique Waters	ADEQ TMDL Program Above Verde River VROAK000.1	1998 - 1 field, nutrients and turbidity	Turbidity NTU	10 (A&Wc)	23	1 of 1		
	ADEQ TMDL Program Above Mormon Crossing VROAK004.9	1998 - 1 field, nutrients and turbidity	OK					
	Reach Summary Row **A&Wc Inconclusive** **FC Inconclusive** **FBC Inconclusive** **DWS Inconclusive** **AgI Inconclusive** **AgL Inconclusive**	**1998** **2 samples** **1 sampling event**	**Turbidity NTU**	**10 (A&Wc)**	**23**	**1 of 2**	**Inconclusive**	**ADEQ collected a total of two samples at two sites in 1998. Assessed as "inconclusive" and added to the Planning List due to lack of sampling events and core parametric coverage.**

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT								
STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	**AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID**	**YEAR SAMPLED NUMBER AND TYPE OF SAMPLES**	**STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT**					
			PARAMETER UNITS	**STANDARD (DESIGNATED USE)**	**RANGE OF RESULTS (MEAN)**	**FREQUENCY EXCEEDED STANDARD**	**DESIGNATED USE SUPPORT**	**COMMENTS**
Pine Creek headwaters-East Verde River RiverAZ15060203-049 A&Wc, FC, FBC, DWS, AgI, AgL	ADEQ Biocriteria Program Above East Verde River VRPIE000.20 100620	1996 - 1 suite 1997 - 1 suite	OK					Missing core parameters
	ADEQ Biocriteria Program Near headquarters VRPIE013.89 100621	1996 - 1 suite 1997 - 1 suite	OK					Missing core parameters.
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive DWS Inconclusive AgI Inconclusive AgL Inconclusive	**1996-1997 4 samples 2 sampling events**	**OK**				**Inconclusive**	**ADEQ collected a total of 4 samples at 2 sites in 1996-1997. Reach assessed as "Inconclusive" and added to the Planning List due to lack of sampling events.**
Pumphouse Wash headwaters-Oak Creek AZ15060202-442 A&Ww, FC, FBC, DWS, AgI, AgL	ADEQ Fixed Station Network Below Highway 89A bridge VRPMW002.63 100460	1997 - 1 suite 1998 - 1 field	OK					
	ADEQ/TMDL Above Oak Creek VRPMW002.7	1998 - 3 nutrients, field, and bact, 4 turbidity	OK					
	ADEQ/TMDL Below Kachina Village VRPMW007.5	1998 - 3 nutrients, field, turbidity, bact	OK					
	ADEQ/TMDL Above Kachina Village VRPMW008.4	1998 - 2 nutrients, field, turbidity, bact	OK					
	Reach Summary Row A&Ww Attaining FC Attaining FBC Attaining DWS Inconclusive AgI Inconclusive AgL Attaining	**1997-1998 10 samples 5 sampling events Missing core parameters**	**OK**				**Inconclusive**	**ADEQ collected a total of 10 samples at 4 sites in 1997-1998. No mining in the drainage area; therefore, metal samples not required. Reach assessed as "attaining some uses" and added to the Planning List due to insufficient core parameters (fluoride and boron).**
Red Creek headwaters-Verde River AZ15060203-818 A&Ww, FC, FBC, AgI, AgL	ADEQ Biocriteria Program Above second road crossing VRRED001.97 100626	1996 - 1 suite	OK					
	Reach Summary Row	**1996 1 sampling events**					**Not assessed**	**Insufficient to data to assess.**

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT								
STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	**AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID**	**YEAR SAMPLED NUMBER AND TYPE OF SAMPLES**	**STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT**					
			PARAMETER UNITS	**STANDARD (DESIGNATED USE)**	**RANGE OF RESULTS (MEAN)**	**FREQUENCY EXCEEDED STANDARD**	**DESIGNATED USE SUPPORT**	**COMMENTS**
Roundtree Creek headwaters-Tangle Creek AZ15060203-853 A&Ww, FC, FBC, AgL	ADEQ Biocriteria Program 3 miles above Tangle Creek VRROU001.79 100631	1996 - 1 suite 1998 - 1 suite	OK					
	Reach Summary Row **A&Ww Inconclusive** **FC Inconclusive** **FBC Inconclusive** **AgL Inconclusive**	**1996 - 1998** **2 sampling events**	**OK**				**Inconclusive**	**ADEQ collected 2 samples in 1996.Reach assessed as "inconclusive" and added to the Planning List due to insufficient sampling events.**
Spring Creek Coffee Creek-Oak Creek AZ15060202-022 A&Ww, FC, FBC, AgI, AgL	ADEQ Ambient and Biocriteria At Ryerson Ranch VRSPN001.68 100197	1997 - 1 suite	OK					Missing core parameters: bacteria
	ADEQ Ambient and Biocriteria Above Diversion Dam VRSPN000.48 100195	1997 - 1 suite	OK					
	ADEQ Ambient and Biocriteria Below Mormon Crossing VRSPN001.25 100196	1997 - 1 suite	OK					
	ADEQ Biocriteria Program Near road crossing VRSPN001.36 100650	1996 - 1 suite 1998 - 1 suite	OK					
	ADEQ Ambient and Biocriteria Below Oak Creek Bridge VRSPN000.15 100194	1997 - 1 suite	OK					
	Reach Summary Row **A&Ww Attaining** **FC Attaining** **FBC Inconclusive** **AgI Attaining** **AgL Attaining**	**1996-1998** **6 samples** **3 sampling events** **Missing core parameters**	**OK**				**Attaining**	**ADEQ collected a total of 6 samples at 5 sites from 1996-1998. Reach assessed as "attaining some uses"and added to the Planning List due to insufficient bacterial samples.**
Sycamore Creek Tule Canyon-Cedar Creek AZ15060202-026 A&Wc, FC, FBC, AgI, AgL	ADEQ Stream Ecosystem Monitoring Near Verde River VRSYW000.56 100198	1997 - 1 suite (no bacterial samples)	OK					Missing core parameters: bacteria and boron No mining in the drainage area; therefore, metal samples not required.

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT								
STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	**AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID**	**YEAR SAMPLED NUMBER AND TYPE OF SAMPLES**	**STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT**					
			PARAMETER UNITS	**STANDARD (DESIGNATED USE)**	**RANGE OF RESULTS (MEAN)**	**FREQUENCY EXCEEDED STANDARD**	**DESIGNATED USE SUPPORT**	**COMMENTS**
	ADEQ Ambient and Biocriteria Below Summers Springs VRSYW001.4 100199	1996 - 1 field 1997 - 1 field plus metals 1998 - 1 suite (No bacterial samples)	OK					Missing core parameters: bacteria. (Turbidity, boron and nitrogen missing except in 1 sample). No mining in the drainage area; therefore, metal samples not required.
	Reach Summary Row **A&Wc Inconclusive FC Attaining FBC Inconclusive AgL Attaining AgI Inconclusive**	**1996-1998** **4 sampling events Missing core parameters**	**OK**				**Inconclusive**	**ADEQ collected a total of 3 samples at 2 sites in 1996-1998; sites close together so assessed as one site. Reach assessed as "attaining some uses" and added to the Planning List due to missing core parameters.**
Sycamore Creek headwaters-Verde River AZ15060203-055 A&Ww, FC, FBC, AgI, AgL	ADEQ Biocriteria Program Tributary of Horseshoe Res. VRSYH000.16 100656	1996 - 1 suite 1998 - 1 suite	OK					Missing core parameters: bacteria
	Reach Summary Row **A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgI Inconclusive AgL Inconclusive**	**1996-1998** **2 sampling events**	**OK**				**Inconclusive**	**ADEQ collected 2 samples in 1996-1998. Reach assessed as "inconclusive" and added to the Planning List due to lack of sampling events.**
Sycamore Creek headwaters-Verde River AZ15060203-002 A&Ww, FC, FBC, AgI, AgL	ADEQ Biocriteria Program In Mazatzal Mountains VRSYM012.45 100659	1996 - 1 suite	OK					
	Reach Summary Row	**1996** **1 sampling event**	**OK**				**Not assessed.**	**Insufficient to data to assess.**
Tangle Creek headwaters-Verde River AZ15060203-028 A&Ww, FC, FBC, AgI, AgL	ADEQ Biocriteria Program Near Tangle Peak VRTGL000.78 100666	1996 - 1 suite	Ok					
	Reach Summary Row	**1996** **1 sampling event**	**OK**				**Inconclusive**	**Insufficient to data to assess.**
Verde River Granite Creek-Hell Canyon AZ15060202-052 A&Ww, FC, FBC, AgI, AgL	ADEQ Biocriteria Program East of Paulden VRVER095.73 100764	1996 - 1 suite 1998 - 1 suite	OK					

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row **A&Ww Inconclusive** **FC Inconclusive** **FBC Inconclusive** **AgL Inconclusive** **AgI Inconclusive**	**1996 - 1998** **2 sampling events**	**OK**				**Inconclusive**	**ADEQ collected a total of 2 samples in 1996-1998. Reach assessed as "inconclusive" and added to the Planning List due to insufficient sampling events.**
Verde River Hell Canyon-15060202-065 AZ15060202-038 A&Ww, FC, FBC, AgI, AgL	ADEQ Ambient and Biocriteria Above Perkinsville bridge VRVER095.54 100672	1996 - 1 field 1999 - 1 suite	OK					Missing core parameters: bacteria
	Reach Summary Row **A&Ww Inconclusive** **FC Inconclusive** **FBC Inconclusive** **AgL Inconclusive** **AgI Inconclusive**	**1996 - 1999** **2 sampling events** **Missing core parameters**	**OK**				**Inconclusive**	**ADEQ collected a total of 2 samples in 1996 - 1999. Reach assessed as "inconclusive"and added to the Planning List due to Insufficient sampling events and lack of bacteria samples.**
Verde River 15060202-065-Railroad Draw AZ15060202-037 A&Ww, FC, FBC, AgI, AgL	ADEQ Fixed Station Network Below Perkinsville Bridge VRVER095.65 100487	1996 - 3 suites + 2 field 1999 - 6 suites 2000 - 4 suites	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	5.72 - 11.1 (74-122 %)	1 of 14		
			Escherichia coli CFU/100 ml	580 (FBC)	2 - 2,300	1 of 13		
			Fecal coliform CFU/100 ml	4,000 (A&Ww, AgI, AgL)	1 - 4,500	1 of 12		
			Turbidity NTU	50 (A&Ww)	1 - 677	4 of 15		
	Reach Summary Row **A&Ww Inconclusive** **FC Attaining** **FBC Attaining** **AgI Attaining** **AgL Attaining**	**1996-2000** **15 samples** **15 sampling events**	**Dissolved oxygen mg/L**	**6.0 (90% saturation) (A&Ww)**	**5.72-11.1 (75-122%)**	**1 of 15**	**Attaining**	**ADEQ collected a total of 15 samples in 1996 - 1999. Reach assessed as "attaining some uses" and added to the Planning List due to turbidity exceedances.**
			***Escherichia coli* CFU/100 ml**	**580 (FBC)**	**2 - 2,300**	**1 of 13**	**Attaining**	
			Fecal coliform CFU/100 ml	**4,000 (A&Ww, AgI, AgL)**	**1 - 4,500**	**1 of 12**	**Attaining**	
			Turbidity NTU	**50 (A&Ww)**	**1 - 677**	**4 of 15**	**Inconclusive**	

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT								
STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	**AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID**	**YEAR SAMPLED NUMBER AND TYPE OF SAMPLES**	**STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT**					
			PARAMETER UNITS	**STANDARD (DESIGNATED USE)**	**RANGE OF RESULTS (MEAN)**	**FREQUENCY EXCEEDED STANDARD**	**DESIGNATED USE SUPPORT**	**COMMENTS**
Verde River Sycamore Creek-Oak Creek AZ15060202-025 A&Ww, FC, FBC, AgI, AgL	USGS/TMDL Above Dead Horse State Park VRVER084.38	1999 - 1 suite	OK					
	ADEQ Ambient and Biocriteria At Dead Horse State Park VRVER84.38 100482	1999 - 2 suites	OK					
	USGS/TMDL Below Dead Horse State Park VRVER084.42	1999 - 1 suite	OK					
	USGS/TMDL At Tuzigoot Bridge VRVER085.49	1999 - 1 suite	OK					
	USGS/TMDL At sewage pond VRVER085.81	1999 - 1 suite	OK					
	USGS/TMDL Above sewage pond VRVER085.92 344615 112023501	1999 - 1 suite	OK					
	USGS/TMDL Below diversion dam VRVER086.62	1999 - 1 suite	OK					
	USGS/TMDL Below Tapco Substation VRVER087.70	1999 - 1 suite	OK					
	USGS Station #09504000 Near Clarkdale VRVER091.61 100738	1996 - 6 suites 1997 - 6 suites 1998 - 6 suites 1999 - 4 suites 2000 - 4 suites	OK					
	Reach Summary Row A&Ww Attaining FC Attaining FBC Attaining AgI Attaining AgL Attaining	**1996 - 2000 34 samples 28 sampling events**	**OK**				**Attaining**	**ADEQ collected a total of 33 samples at 8 sites in 1996 -2000. Reach assessed as "attaining all uses."**
Verde River Oak Creek-Beaver Creek AZ15060202-015 A&Ww, FC, FBC, AgI, AgL	ADEQ TMDL Program Across from Reservation VRVER075.14 100718	1999 - 1 suite	OK					No bacterial samples.

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ Biocriteria & TMDL At 1000 Trails VRVER078.76 100481	1996 - 1 suite 1999 - 1 suite	OK					No bacterial samples
	ADEQ TMDL Program Below Oak Creek VRVER078.8	1998 - 1field, nutrient	OK					Lacking core parametric coverage
	Reach Summary Row **A&Ww Inconclusive** **FC Inconclusive** **FBC Inconclusive** **AgI Inconclusive** **AgL Inconclusive**	**1996 - 1999** **4 samples** **3 sampling events** **Missing core parameters at 1 event.**	**OK**				**Inconclusive**	**ADEQ collected a total of 4 samples at 3 sites 1996-1999. Reach assessed as "inconclusive" and added to the Planning List due to missing core parameters at one of the three sampling events.**
Verde River 15060203-West Clear Creek AZ15060203-027 A&Ww, FC, FBC, AgI, AgL	ADEQ Biocriteria Program Above West Clear Creek VRVER066.74 100723	1996 - 1 suite 1999 - 1 suite	OK					No bacterial samples.
	USGS #09505570 Above West Clear Creek VRVER066.64 100750	1996 - 10 suites 1997 - 5 suites 1998 - 6 suites	OK					No bacterial samples.
	Reach Summary Row **A&Ww Attaining** **FC Attaining** **FBC Inconclusive** **AgI Attaining** **AgL Attaining**	**1996 - 1999** **23 sampling events** **Missing core parameters (bacteria)**	**OK**				**Attaining**	**ADEQ and USGS collected at total of 25 samples at 2 sites 1996-1999. Reach assessed as "attaining some uses" and added to the Planning List due to missing core parameters.**
Verde River West Clear Creek-Fossil Creek AZ15060203-025 A&Ww, FC, FBC, AgI, AgL	ADEQ Fixed Station Program At Beasley Flat VRVER064.68 100477	1999 - 4 suites 2000 - 4 suites	Escherichia coli CFU/100 ml	580 (FBC)	<2- 1,125	1 of 8		
			Turbidity NTU	50 (A&Ww)	7-998	3 of 8		
	USGS TMDL At Beasley Flat VRVER064.68	1999 - 1 suite	Turbidity NTU	50 (A&Ww)	77	1 of 1		
	Reach Summary Row **A&Ww Inconclusive** **FC Attaining** **FBC Inconclusive** **AgI Attaining** **AgL Attaining**	**1999 - 2000** **9 samples**	**Escherichia coli CFU/100 ml**	**580 (FBC)**	**<2- 1,125**	**1 of 9**	**Inconclusive**	**ADEQ and USGS collected a total of 9 samples at 2 sites 1999-2000. Reach assessed as "attaining some uses" and added to the Planning List due to E. coli and turbidity exceedances.**
			Turbidity NTU	**50 (A&Ww)**	**1-998**	**4 of 9**	**Inconclusive**	

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Verde River Tangle Creek-Ister Flat AZ15060203-018 A&Ww, FC, FBC, AgI, AgL	USGS Station #09508500 Below Tangle Creek VRVER036.48 100740	1996 - 8 suites 1997 - 15 suites 1998 - 6 suites 1999 - 6 suites 2000 - 4 suites	*Escherichia coli* CFU/100 mg/L	580 (FBC)	<1.0-770	1 of 13		
			Turbidity NTU	50 (A&Ww)	0.3-170	4 of 14		
	SRP Routine Monitoring Below Tangle Creek	2000 - 11 suites	OK					Missing core parameters: bacteria, nutrients, nitrates, turbidity, dissolved oxygen, flow, some metals, beryllium, fluoride, barium, boron, pH.
	ADEQ Biocriteria Program Above Sheep Bridge VRVER036.65 100678	1999 - 1 suite	OK					Missing core parameters: bacteria
	Reach Summary Row **A&Ww Inconclusive** **FC Attaining** **FBC Attaining** **DWS Attaining** **AgI Attaining** **AgL Attaining**	**1996 - 2000** **51 sampling events**	***Escherichia coli*** **CFU/100 mg/L**	**580** **(FBC)**	**<1.0-770**	**1 of 13**	**Attaining**	**ADEQ, USGS, and SRP collected a total of 105 samples in 1996-2000 at 4 sites. Reach is assessed as "attaining some uses" and added to the Planning List due to turbidity exceedances.**
			Turbidity **NTU**	**50** **(A&Ww)**	**0.3-170**	**4 of 15**	**Inconclusive**	
Verde River Horseshoe Lake-Bartlett Lake AZ15060203-008 A&Ww, FC, FBC, AgI, AgL	ADEQ Fixed Station Monitoring Below Horseshoe Lake VEVER027.54 100831	1999 - 1 suite	OK					
	Reach Summary Row	**1999** **1 sampling event**	**OK**				**Not assessed**	**Insufficient samples to assess.**
Verde River Bartlett Dam-Camp Creek AZ15060203-004 A&Ww, FC, FBC, DWS, AgI, AgL	SRP Routine Monitoring Below Bartlett Dam VRVER017.55	1996 - 12 suites 1997 - 12 suites 1998 - 7 suites 1999 - 13 suites 2000 - 12 suites	OK					Missing core parameters: bacteria, flow, fluoride, barium, beryllium. some metals, pH, dissolved oxygen, turbidity.
	USGS Station #09510000 Below Bartlett Dam 100741	1999 - 3 suites 2000 - 6 suites	OK					Missing core parameters: bacteria
	Reach Summary Row **A&Ww Attaining** **FC Attaining** **FBC Inconclusive** **DWS Attaining** **AgI Attaining** **AgL Attaining**	**1996 - 2000** **65 sampling events** **Missing bacteria samples**	**OK**				**Attaining**	**ADEQ, USGS, and SRP collected a total of 105 samples in 1996-2000 at 4 sites. Reach is assessed as "attaining some uses" and added to the Planning List due to missing bacteria samples.**

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Walnut Creek Apache Creek-Big Chino Wash AZ15060201-017 A&Ww, FC, FBC, AgI, AgL	ADEQ Biocriteria Program Above Road 95 VRWAL011.07 100681	1996 - 1 suite	OK					Need more data to assess. Staff documented that low dissolved oxygen was due to ground water upwelling that is naturally low in dissolved oxygen; therefore, not considered in the final assessment.
	Reach Summary Row	**1996** **1 sampling event**	**OK**				**Not assessed**	**Insufficient data to assess.**
Webber Creek headwaters-East Verde River AZ15060203-058 A&Wc, FC, FBC, AgL	ADEQ Biocriteria Program Below Geronimo Scout Camp VRWEB006.03 100690	1996 - 1 suite 1997 - 1 suite	OK					Need more data to assess.
	Reach Summary Row **A&Wc Inconclusive** **FC Inconclusive** **FBC Inconclusive** **AgL Inconclusive**	**1999-1997** **2 sampling events**	**OK**				**Inconclusive**	**ADEQ collected 2 samples in 1996-1997. Reach assessed as "inconclusive"and added to the Planning List due to lack of sampling events.**
West Clear Creek headwaters-Verde River AZ15060203-026 A&Wc, FC, FBC, AgL	ADEQ Stream Ecosystem Above diversion VRWCL000.94 100200	1997 - 1 suite	Turbidity NTU	10 (A&Wc)	24	1 of 1		Missing core parameters: bacterial samples.
	ADEQ Stream Ecosystem above lower campground VRWCL002.66 100201	1997 - 1 suite	OK					Missing core parameters: bacterial samples.
	ADEQ Biocriteria Program At campground VRWCL002.91 100689	1996 - 1 suite 1999 - 1 suite	OK					Missing core parameters: bacterial samples.
	ADEQ Stream Ecosystem SW of Cactus Mountain VRWCL003.19 100202	1997 - 1 suite	OK					Missing core parameters: bacterial samples.
	ADEQ Stream Ecosystem Below Bull Pen Ranch VRWCL004.93 100203	1997 - 1 suite	OK					Missing core parameters: bacterial samples.
	USGS #09505800 Near Camp Verde VRWCL005.79 100749	1996 - 8 suites 1997 - 12 suites 1998 - 16 suites 1999 - 12 suites 2000 - 6 suites						Missing core parameters: turbidity, nitrogen, most metals, bacterial samples.

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ Biocriteria Program Above Bull Pen Ranch VRWCL006.09 100204	1997 - 1 suite 1998 - 1 suite 1999 - 1 suite	OK					Missing core parameters: bacterial samples.
	ADEQ Biocriteria Program At Callaway Butte VRWCL012.50 100687	1996 - 1 suite	OK					Missing core parameters: bacterial samples.
	ADEQ Biocriteria Program At Maxwell Trail (upper) VRWCL0016.84 100205	1996 - 1 suite 1997 - 2 suites	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	5.9 - 8.1	1 of 3		Natural low dissolved oxygen due to ground water upwelling and low flow. This exceedance was not included in the final assessment. Missing core parameters: bacteria.
	Reach Summary Row **A&Wc Attaining** **FC Attaining** **FBC Inconclusive** **AgL Attaining**	**1996-2000** **66 samples** **58 sampling events** **Missing core parameters**	**Turbidity (NTU)**	**10 (A&Wc)**	**1-24**	**1 of 12**	**Attaining**	**ADEQ and USGS collected a total of 66 samples at 7 site in 1996-2000. Reach assessed as "attaining some uses" and added to the Planning List due to lack of bacteria samples.**
West Fork Oak Creek headwaters-Oak Creek AZ15060202-020 A&Wc, FC, FBC, AgL	ADEQ Biocriteria Program Above Fourth Trail Crossing VRWOK000.64 100693	1996 - 1 suite 1998 - 1 suite	OK					
	Reach Summary Row **A&Wc Inconclusive** **FC Inconclusive** **FBC Inconclusive** **AgL Inconclusive**	**1996-1998** **2 sampling events**	**OK**				**Inconclusive**	**ADEQ collected 2 samples in 1996-1998. Reach assessed as"inconclusive" and added to the Planning List due to insufficient sampling events.**
Wet Beaver Creek Long Canyon-Rarick AZ15060202-004 A&Wc, FC, FBC, AgI, AgL	ADEQ TMDL Program At Montezuma Well VRWBV003.18	1999 - 1 field, nutrients, turbidity 2000 - 2 field, nutrients, turbidity	OK					Missing core parameters
	ADEQ TMDL Program At camp ground VRBEV004.95	1999 - 1 field, nutrients, turbidity 2000 - 2 field, nutrients, turbidity	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.7-9.4 (86.9-93.3%)	1 of 3		Missing core parameters
	ADEQ Biocriteria Program At campground VRWBV005.06 100684	1999 - 1 suite	OK					Missing core parameters: bacteria.
	ADEQ Biocriteria &TMDL Above USGS gage at Rimrock VRWBV006.79 100765	1998 - 1 suite 1999 - 1 suite 2000 - 2 field, nutrients, turbidity	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.65 (75.2%)	1 of 1		Missing core parameters: no bacterial samples, only 1 beryllium, boron, manganese, chromium, zinc, mercury, arsenic, lead.

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row **A&Wc Inconclusive** **FC Inconclusive** **FBC Inconclusive** **AgI Inconclusive** **AgL Inconclusive**	**1998 - 2000** **11 samples** **4 sampling events** **Missing core parameters**	**Dissolved oxygen mg/L**	**7.0 (90% saturation) (A&Wc)**	**6.65-9.4 (75.2 -101%)**	**1 of 11**	**Attaining**	**ADEQ collected a total of 11 samples at 5 sites in 1998-2000. Reach assessed as "inconclusive" due to insufficient core parametric coverage**
Wet Bottom Creek headwaters-Verde River AZ15060203-020 A&Ww, FC, FBC, AgI, AgL	USGS Station #09508300 Near Childs VRWET000.94 100777	1996 - 2 field	OK					Not perennial stream flow
	Reach Summary Row **A&Ww Inconclusive** **FC Inconclusive** **FBC Inconclusive** **AgL Inconclusive**	**1996** **2 sampling events**	**OK**				**Inconclusive**	**USGS collected 2 field samples in 1996. Reach assessed as "inconclusive" due to insufficient sampling events and core parametric coverage.**
LAKE MONITORING DATA								
Bartlett Lake AZL15060203-0110 A&Ww, FC, FBC, DWS, AgI, AgL	ADEQ Lakes Program VRBAR-A 100009	1996 - 1 suite 1997 - 3 suites 1998 - 4 suites 1999 - 2 suites 2000 - 1 suite, 1 field	OK					Missing core parameters: bacteria
	ADEQ Lakes Program VRBAR-B 100010	1996 - 2 field 1997 - 2 suites 1998 - 3 suites 1999 - 1 suite, 1 field 2000 - 1 field	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	5.7-12.2 (63-130%)	1 of 8		
	ADEQ Lakes Program VRBAR-C 100011	1996 - 1 suite 1997 - 2 suites 1998 - 3 suites 1999 - 4 suites 2000 - 2 suites	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.9-11.5	1 of 7		
			Turbidity NTU	25 (A&Ww)	3-28	1 of 7		This turbidity exceedance was due to an upstream dam release; therefore, it is excluded in the final assessment (R18-11-118).
	ADEQ Lakes Program VRBAR-NTU1 100980	1999 - 1 turbidity	OK					Missing core parameters: bacteria.
	ADEQ Lakes Program VRBAR-NTU2 100981	1999 - 1 turbidity	OK					
	ADEQ Lakes Program VRBAR-NTU3 100982	1999 - 2 field, turbidity 2000 - 2 suites	OK					

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ Lakes Program VRBAR-NTU4 100983	1999 - 2 field, 3 turbidity 2000 - 1 suite	OK					
	ADEQ Lakes Program VRBAR-NTU5 100984	1999 - 1 field	OK					
	Reach Summary Row **A&Ww Attaining** **FC Attaining** **FBC Inconclusive** **DWS Attaining** **AgI Attaining** **AgL Attaining**	**1996-2000** **44 samples** **12 sampling events** **Missing core parameters**	**Dissolved oxygen mg/L**	**6.0 (90% saturation) (A&Ww)**	**5.68-12.19**	**2 of 29**	**Attaining**	**ADEQ collected at total of 44 samples at 8 sites in 1996-2000. Lake is assessed as "attaining some uses" and added to the Planning List due to missing core parameters (bacteria).**
Granite Basin Lake AZL15060202-0580 A&Ww, FC, FBC, AgI, AgL	ADEQ Lakes Program VRGBL - A 100024	1997 - 4 suites 1999 - 3 suites 2000 - 1 suite	Arsenic (total) µg/L	50 (FBC)	<10-69	1 of 7		Median result of samples on the date with a recorded exceedance was <10 (not exceeding standard); therefore, exceedance was not included in the final assessment.
			Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.25-15.45 (49%-159%)	3 of 7		Depth for lead was 1.75 meters.
			Lead (total) µg/L	100 (AgL) 10,000 (AgI)	5-23,000	1 of 8		Median result of all samples on the date with a recorded exceedance was <10; therefore, exceedance was not included in the final assessment.
			Manganese µg/L	10, 000 (AgI)	<50-12,000	1 of 8		Median result of all samples on the date with a recorded exceedance was <10; therefore, exceedance was not included in the final assessment.
	ADEQ Lakes Program VRGBL - B 100025	1999 - 3 suites 2000 - 1 suite	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	3.14-10.24 (45%-127.5%)	1 of 3		
			pH (high) SU	6.5-9.0 (A&Ww, FBC, AgL) 4.5-9.0 (AgI)	7.1-9.5	1 of 4		
	Reach Summary Row **A&Ww Inconclusive** **FC Attaining** **FBC Inconclusive** **AgI Inconclusive** **AgL Inconclusive**	**1997-2000** **8 sampling events** **Missing core parameters**	**Dissolved oxygen mg/L**	**6.0 (90% saturation) (A&Ww)**	**4.25-15.45 (49%-159%)**	**3 of 7**	**Inconclusive**	**ADEQ collected a total of 8 samples at 2 sites in 1997-2000. Lake assessed as "attaining some uses"and added to the Planning List due to exceedances of dissolved oxygen and pH and Insufficient parametric coverage (beryllium, turbidity, bacteria)**
			pH (high) SU	**6.5-9.0 (A&Ww, FBC, AgL) 4.5-9.0 (AgI)**	**7.1-9.5**	**1 of 8**	**Inconclusive**	
Green Valley Lake AZL15060203-0015 A&Ww, FC, PBC	AGFD Routine Monitoring VRGRE - site 1	1997 - 1 field and nutrients	pH (high) SU	>6.5-<9.0 (A&Ww, PBC)	9.46	1 of 1		
	AGFD Routine Monitoring VRGRE - site 2	1997 - 1 field and nutrients	pH (high) SU	>6.5-<9.0 (A&Ww, PBC)	9.45	1 of 1		

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row **A&Ww Inconclusive** **FC Inconclusive** **PBC Inconclusive**	**1997** **2 samples** **1 sampling event**	**pH (high) SU**	**>6.5-<9.0 (A&Ww, PBC)**	**9.45-9.46**	**2 of 2**	**Inconclusive**	**AGFD collected a total of 2 field samples at 2 sites in 1997. Lake assessed as "inconclusive"and added to the Planning List due to pH exceedance, lack of sampling events, and core parameters.**
Horseshoe Reservoir AZL15060203-0620 A&Ww, FC, FBC, AgI, AgL	ADEQ Clean Lakes Program VRHSR	1997 - 1 suite	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	5.73-5.86 (62.7-65.8%)	1 of 1		
	Reach Summary Row **A&Ww Inconclusive** **FBC Inconclusive** **FC Inconclusive** **AgI Inconclusive** **AgL Inconclusive**	**1997** **1 sampling event**	**Dissolved oxygen mg/L**	**6.0 (90% saturation) (A&Ww)**	**5.73-5.86 (62.7-65.8%)**	**1 of 1**	**Inconclusive**	**Lake assessed as "inconclusive" and added to the Planning List due to low dissolved oxygen.**
Pecks Lake AZL15060202-1060 A&Wc, FC, FBC, AgI, AgL	ADEQ Lakes Program VRPEC-A 100063	1997 - 4 suites 1999 - 3 suites 2000 - 2 suites	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	4.0-11.7	3 of 8		Missing core parameters: bacteria
			Mercury (total) µg/L	0.6 (FC)	<0.5-0.9	1 of 8		Median result did not exceed standard.
			pH (high) SU	6.5-9.0 (A&Wc, FBC, AgI)	6.8-9.7	2 of 8		
	ADEQ Lakes Program VRPEC-AA 100511	1999 - 1 suite 2000 - 1 suite	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	2.03 - 8.26 (18-85% sat.)	1 of 2		Missing core parameters: bacteria
	ADEQ Lakes Program VRPEC-F 1005113	1999 - 2 suites	OK					
	Reach Summary Row **A&Wc Not attaining** **FC Attaining** **FBC Inconclusive** **AgI Attaining** **AgL Attaining**	**1999-2000** **12 sampling events** **Missing core parameters**	**Dissolved oxygen mg/L**	**7.0 (90% saturation) (A&Wc)**	**2-11.7**	**4 of 12**	**Not attaining**	**ADEQ collected a total of 12 samples at 3 sites in 1997-2000. Reach assessed as "not attaining" due to EPA approval of a DO and pH TMDL in 2000. Added to Planning List to evaluate the effectiveness of TMDL implementation strategies.**
			pH (high) SU	**6.5-9.0 (A&Wc, FBC, AgI)**	**6.8-9.7**	**2 of 12**	**Attaining (TMDL approved)**	
Stehr Lake AZL15060203-1480 A&Ww, FC, FBC, AgL	ADEQ Lakes Program VRSTH-A 100085	1996 - 1 suite 1997 - 3 suites	OK					Missing core parameters: bacteria, nitrogen
	Reach Summary Row **A&Ww Inconclusive** **FC Attaining** **FBC Inconclusive** **AgL Attaining**	**1996-1997** **4 sampling events** **Missing core parameters**	**OK**				**Attaining**	**ADEQ collected a total of 3 samples in 1997. Lake assessed as "attaining some uses" due to missing core parameters.**
Stoneman Lake AZL15060202-1490 A&Wc, FC, FBC, AgI, AgL	ADEQ Lakes Program VRSTN-A 100086	1996 - 1 suite 1997 - 3 suites 1999 - 4 suites	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	4.5-13.9 (62.7-106%)	1 of 8		Missing core parameters: bacteria
			pH SU	6.5-9.0 (A&Wc, FBC, AgI, AgL)	6.82-9.9	3 of 7		

TABLE 31. VERDE WATERSHED -- MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ Lakes Program VRSTN-B 100698	1999 - 3 suites	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.7 (82%)	1 of 3		May be naturally low dissolved oxygen due to ground water recharge.
			pH SU	6.5-9.0 (A&Wc, FBC, AgI, AgL)	8.81 - 9.62	1 of 3		Missing core parameters: bacteria
	Reach Summary Row **A&Wc Not attaining** **FC Attaining** **FBC Not attaining** **AgI Not attaining** **AgL Not attaining**	**1996-1999** **8 sampling events (Sample results were combined due to close proximity)** **Missing core parameters**	**Dissolved oxygen mg/L**	**7.0 (90% saturation) (A&Wc)**	**4.5-13.9 (65-106%)**	**1 of 8**	**Not attaining**	**ADEQ collected a total of 8 samples at 2 sites in 1996-1999. Lake assessed as "not attaining" due to dissolved oxygen, pH, narrative nutrient TMDL completed 2000. Add to Planning list to assess the effectiveness of TMDL implementation strategies and missing core parameters.**
			pH SU	**6.5-9.0 (A&Wc, FBC, AgI, AgL)**	**8.8 - 9.6**	**3 of 7**	**Not attaining**	
Sullivan Lake AZL15060202-3370 A&Ww, FC, FBC, AgI, AgL	ADEQ Clean Lakes Program VRSUL-A 100088	1997 - 3 suites	pH (high) SU	>6.5-<9.0 (A&Ww, FBC, AgI, AgL)	8.4-9.7	1 of 3		Lake is silted to top of dam. Missing core parameters: nutrients, bacteria, beryllium
	Reach Summary Row **A&Ww Inconclusive** **FC Attaining** **FBC Inconclusive** **AgI Attaining** **AgL Attaining**	**1997** **3 samples**	**pH (high) SU**	**>6.5-<9.0 (A&Ww, FBC, AgI, AgL)**	**8.4-9.7**	**1 of 3**	**Inconclusive**	**ADEQ collected a total of 3 samples in 1997. Lake assessed as "attaining some uses"and added to the Planning List due to pH exceedance and missing core parameters.**
Whitehorse Lake AZL15060202-1630 A&Wc, FC, FBC, DWS, AgI, AgL	ADEQ Lakes Program VRWHH - A 100090	1997 - 4 suites 1999 - 2 suites 2000 - 3 suites	Dissolved oxygen mg/L	>7.0 (90% saturation) (A&Wc)	0.59-10.4 (0.06-145%)	4 of 8		Missing core parameters: bacteria
			pH SU	6.5-9.0 (A&Wc, FBC, AgL) 4.5-9.0 (AgI) 5.0-9.0 (DWS)	6.15-9.6 (7.0)	2 of 9 1 of 9 1 of 9		
			Turbidity NTU	10 (A&Wc)	39	8 of 8		Laboratory values used instead of field results
	ADEQ Lakes Program VRWHH-B 100724	1999 - 2 field, nutrients 2000 - 1 field	Dissolved oxygen mg/L	>7.0 (90% saturation) (A&Wc)	5.75-9.98 (73%-148%)	1 of 3		Missing core parameters: bacteria
			pH SU	6.5-9.0 (A&Wc, FBC, AgL) 4.5-9.0 (AgI) 5.0-9.0 (DWS)	7.1-9.6	1 of 3 1 of 3		
			Turbidity NTU	10 (A&Wc)	13-56	11 of 11		Laboratory values used instead of field results
	Reach Summary Row **A&Ww Inconclusive** **FC Attaining** **FBC Inconclusive** **DWS Attaining** **AgI Attaining** **AgL Inconclusive**	**1999-2000** **12 samples** **9 sampling events** **Missing core parameters.**	**Dissolved oxygen mg/L**	**>7.0 (90% saturation) (A&Wc)**	**5.75-9.98 (73%-148%)**	**5 of 11**	**Inconclusive**	**ADEQ collected a total of 12 samples at 2 sites from 1997-2000. Lake is assessed as "attaining some uses" and added to the Planning List due to dissolved oxygen, pH, and turbidity exceedances and missing core parameters.**
			pH (High)	**6.5-9.0 (A&Wc, FBC, AgL) 4.5-9.0 (AgI) 5.0-9.0 (DWS)**	**6.2-9.6**	**3 of 12 1 of 12 1 of 12**	**Inconclusive**	
			Turbidity NTU	**10 (A&Wc)**	**13-56**	**11 of 11**	**Inconclusive**	

Information for interpreting these Monitoring Tables

- "Segment" designates the beginning and end points of the reach.
- "Waterbody ID" is derived from combining the following: AZ (for streams) or AZL (for lakes) + a US Geological Survey Hydrologic Unit Code + EPA stream reach number or ADEQ lake number.
- "Designated Uses," "Agency," and "Units" (of measurement) abbreviations are defined in Appendix A.
- "Site Code" is an ADEQ derived abbreviation for the surface water basin, stream name or lake name, and the location of the site. For streams, the numbers are the miles upstream from mouth (normally measured as a straight line vector).
- "ADEQ Database ID" -- This is ADEQ's water quality database reference number. If the data is not in this database, no number will be shown.
- "Samples" -- The year and number of water samples is shown. The federal "water year" is used, from October 1st through September 30th, rather than the calendar year. Types of samples:
  - < "Suite" indicates that a broad range of chemical constituents were collected and field measurements were taken (normally inorganics, metals, nutrients, and bacteria.) The chemical constituents monitored are not consistent among the many monitoring entities that provided the data. If the suite did not include the core parameters needed to assess a designated use as "attaining," the missing core parameters are indicated.
  - < "Field" indicates that only field measurements such as dissolved oxygen, pH, turbidity, and water temperature were collected.
  - < If a specific parameter or parametric group (e.g., zinc, metals, bacteria) is named, monitoring was limited to only these parameters
- "Standards Exceeded at this Site per Sampling Event."
  - < Although many parameters may be analyzed, only those exceeding a standard are shown. Other parameters were collected.
  - < "OK" indicates that no standards were exceeded.
  - < The specific standards are shown as a single parameter may have multiple standards depending on the designated uses assigned. (See standards in Appendix C.)
  - < "The Range of Results" indicates the minimum and maximum sample results. If the laboratory reported result is "less than the detection limit" or "not detected," a less than (<) value will be shown along with the detection limit (e.g., <0.5 mg/L).
  - < A mean, geometric mean, or median will be shown along with the range of results if applicable to the standard or assessment criteria.
- "Comments" include other information used in interpreting the data for assessments, such as evidence that exceedance is solely due to natural conditions, or that the data does not meet the new "credible" data requirements.
- In the "Summary Row" parameter exceedances are combined from multiple sites, and the assessment of each designated use is shown. The overall assessment for the surface water is described in the "Comments" field: "Attaining," "Not attaining," "Impaired," or " Inconclusive." See assessment criteria in Chapter III of Volume I.

Ground Water Assessments in the Verde Watershed

Major Ground Water Stressors -- Monitoring data collected from wells in this watershed between October 1995-October 2000 are summarized in **Table 32** and illustrated in **Figures 60, 61, and 62.** Wells are sampled for different constituents and samples were not collected uniformly across the watershed but were collected generally as part of a special study.

Of the 118 wells monitored, few exceeded standards for radiochemicals, fluoride, metals, or nitrate. No wells exceeded pesticide standards although the Verde Valley has had extensive agricultural crop production. The location of the wells monitored and the wells exceeding standards is illustrated in **Figure 60**. Volatile organic chemicals (VOCs) exceeded standards in the Payson area. These samples were collected as part of the Superfund remediation site investigation which is described in the final section of this watershed report.

TDS Concentrations -- Water quality can be characterized based on concentration of Total Dissolved Solids (TDS). High levels of salinity can limit the practical uses of ground water, as TDS over 500 mg/L has an off-flavor, and TDS over 1000 mg/L will limit its use for some crops. As indicated in **Table 32** and illustrated in **Figure 61**, TDS does not appear to be generally elevated in this watershed; however, TDS testing was concentrated in only one region.

No TDS water quality standards apply in this watershed, as elevated levels of TDS do not present a human-health concern for drinking water. The TDS concentration is only used to generally characterize water quality. In the Verde Watershed, the lack of elevated TDS would indicate excellent ground water quality.

Nitrate Concentrations -- Water quality can also be characterized by looking at the concentration of nitrates in ground water. In Arizona, natural occurring nitrate concentrations in ground water are generally below 3 mg/L and concentrations above 5 mg/L indicate potential anthropogenic sources of nitrates. Of the 90 tested for nitrate concentration, 17 wells (19%) exceeded this level. As illustrated in **Figure 62**, elevated nitrates occur in the Payson area and north of Prescott. Irrigated agriculture, septic systems, and other wastewater disposal facilities are may be sources of this nitrate.

When nitrate concentrations exceed 10 mg/L, Arizona's Aquifer Water Quality Standard has been exceeded. This standard was set to protect human health ,as water with nitrate greater than 10 mg/L may present a health problem for infants and should not be consumed by nursing mothers. Only two wells in the Payson area exceeded this level. As many of the wells sampled are irrigation wells (not used for drinking water), nitrates over 10 mg/L may not represent a human-health concern in this watershed. However, efforts should be made to minimize further contamination of ground water by nitrate.

Table 32. Verde Watershed Ground Water Monitoring 1996 - 2000

MONITORING DATA TYPE	PARAMETER OR PARAMETER GROUP	NUMBER OF WELLS			PERCENT OF WELLS EXCEEDING STANDARDS
		SAMPLED	SYNTHETIC CONSTITUENT DETECTED*	EXCEEDING STANDARDS	
INDEX WELLS	Radiochemicals	9		1	11%
	Fluoride	41		2	5%
	Metals/Metalloids	42		2	5%
	Nitrate	42		0	0%
	VOCs + SVOCs*	2	1	0	0%
	Pesticides	2	0	0	0%
TARGETED MONITORING WELLS	Radiochemicals	3		0	0%
	Fluoride	17		0	0%
	Metals/metalloids	52		0	0%
	Nitrate	48		2	4%
	VOCs + SVOCs*	76	46	32	42%
	Pesticides	75	0	0	0%

WELL CLASSIFICATION BY TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATION				
Total Number of Wells	Wells <500 mg/L Acceptable drinking water flavor	Wells 500-999 mg/L Fresh (not saline) Some crop production problems	Wells 1000-3000 mg/L Slightly saline Increasing crop production problems	Wells >3000 mg/L Moderately saline to briny Severe crop production problems
55	43	3	0	0

WELL CLASSIFICATION BY NITRATE CONCENTRATION (measured as Nitrogen)			
Total Number of Wells	Wells <5 mg/L	Wells 5-10 mg/L May be an anthropogenic source of Nitrates	>10 mg/L Exceeds standards Should not be used for drinking water by babies or nursing mothers
90	73	15	2

*VOCs = volatile organic compounds; SVOCs = semi-volatile organic compounds.
*The detection of a synthetic constituent (pesticides, VOCs, and SVOCs) is noted because some do not have standards and these substances are not naturally occurring in the ground water.

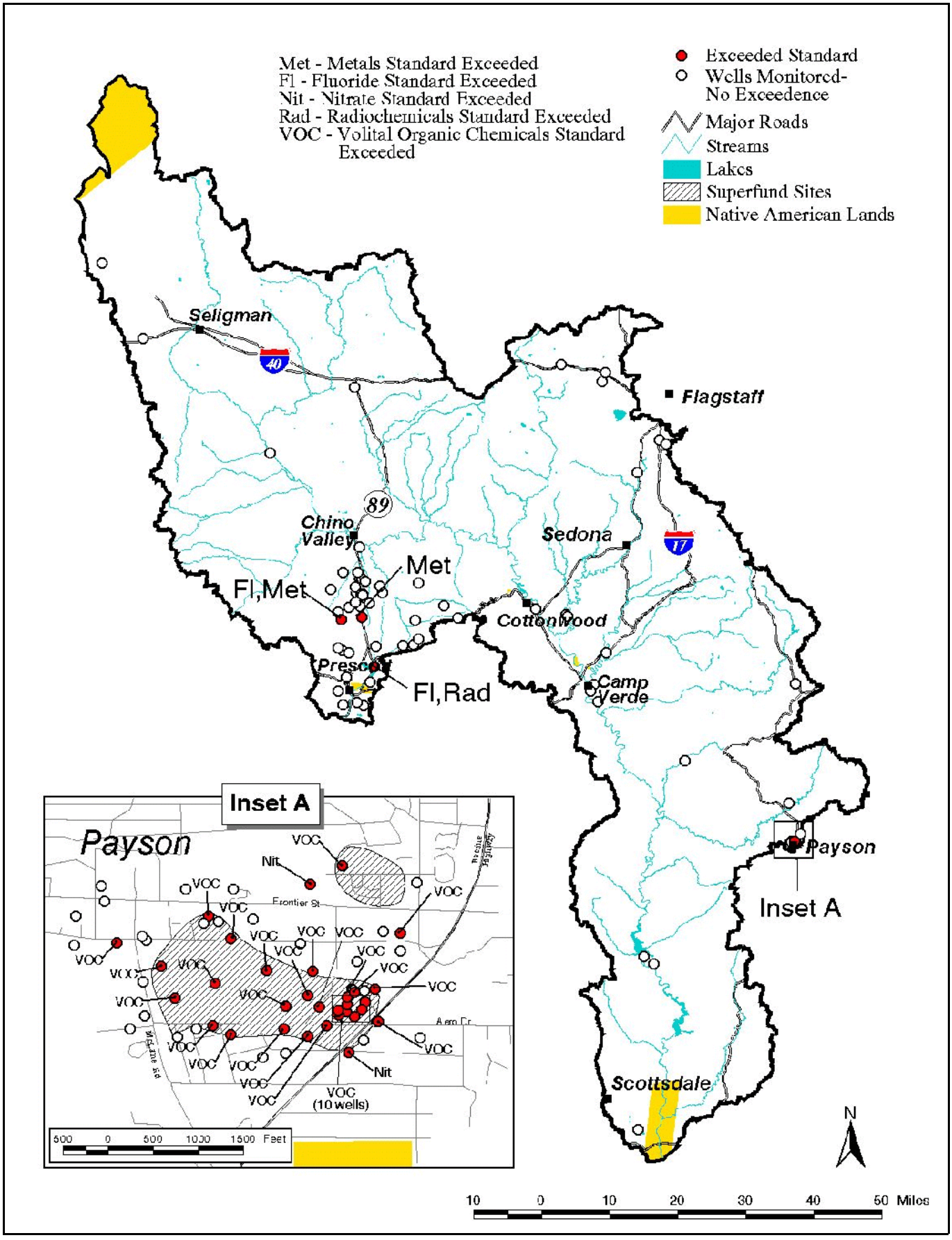

Figure 60. Ground Water Quality Monitoring in the Verde Watershed – 1996-2000

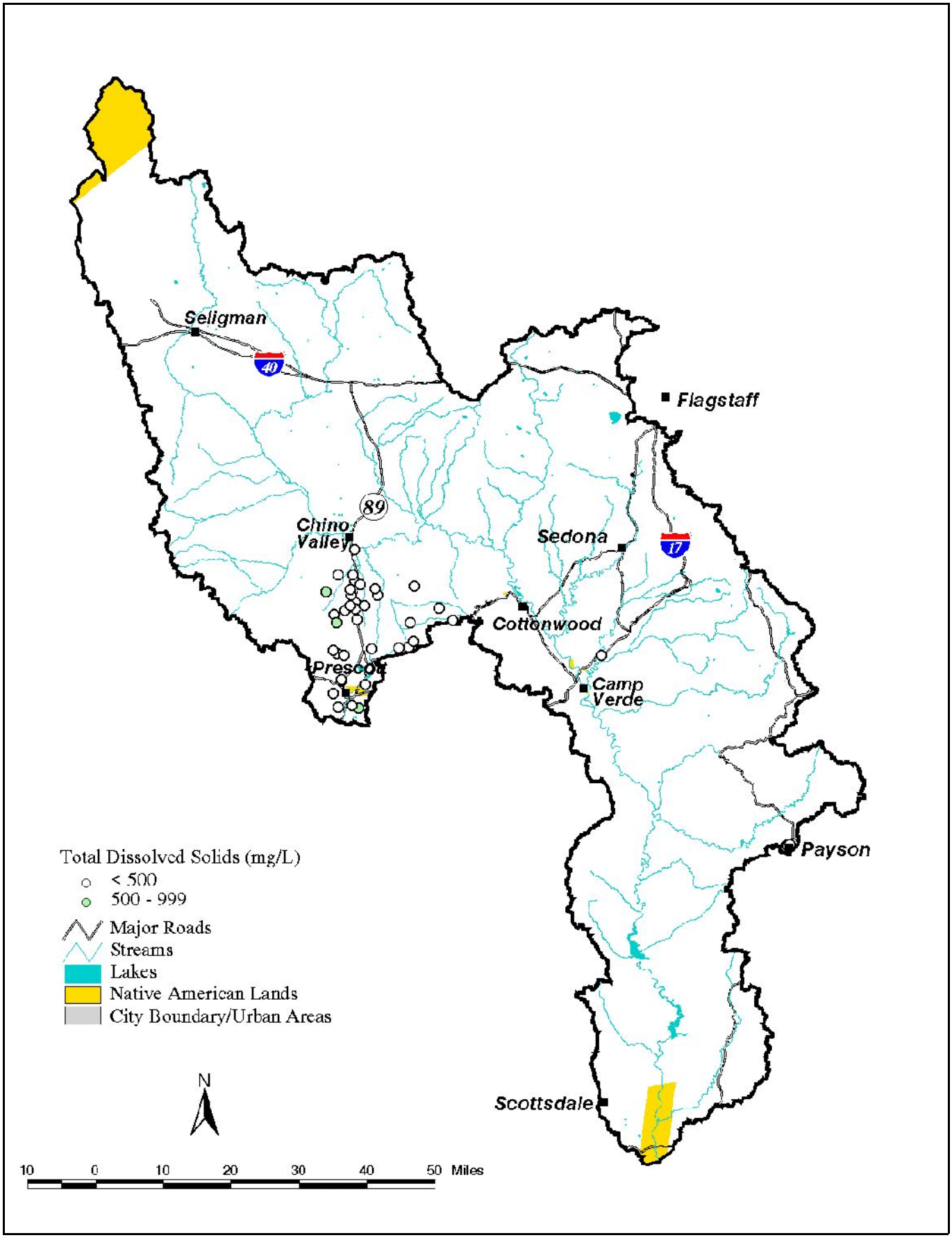

Figure 61. Classification of Water Quality by TDS Concentrations in the Verde Watershed

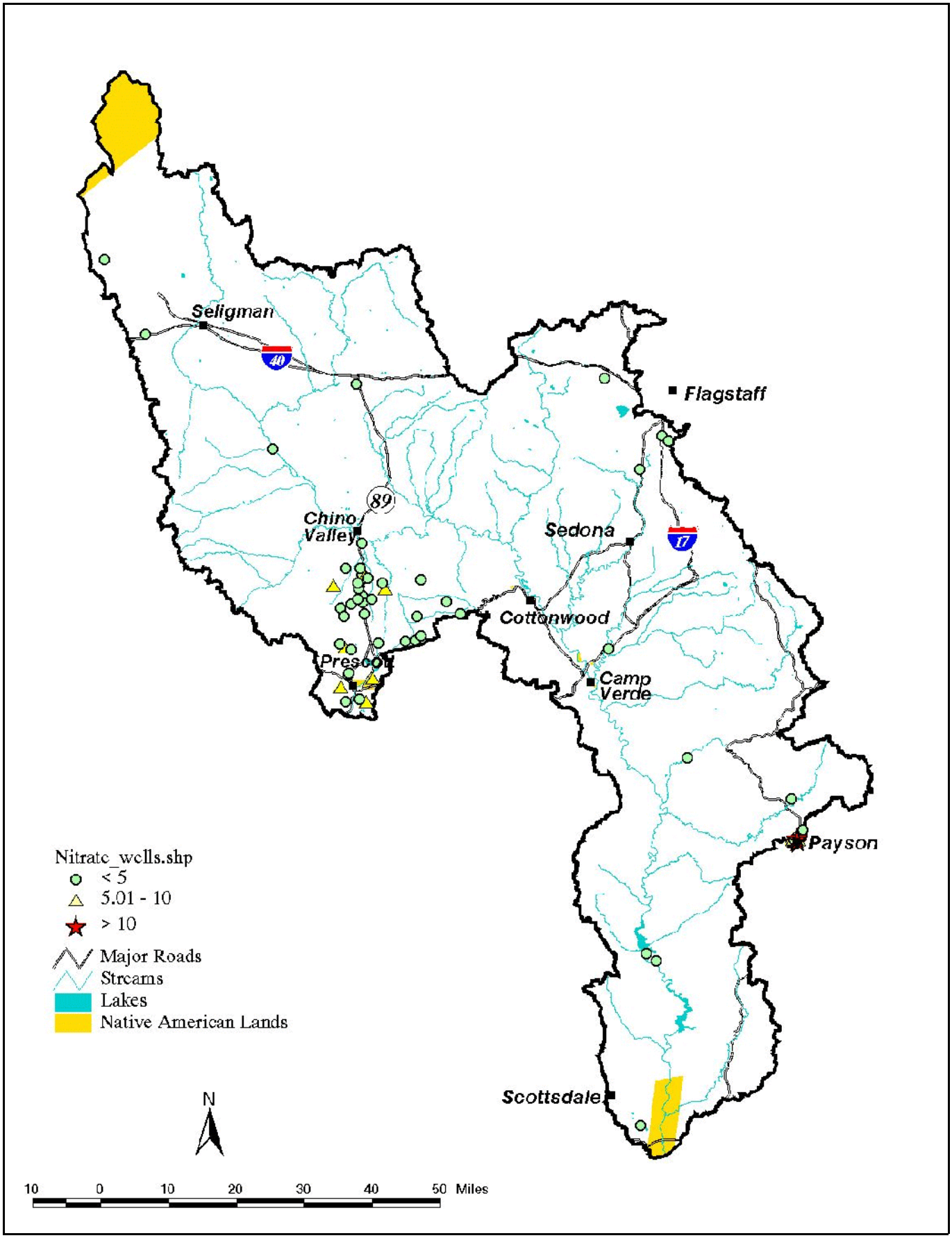

Figure 62. Classification of Water Quality by Nitrate Concentrations in the Verde Watershed

Surface Water Studies and Mitigation Projects

This section highlights surface and ground water studies, mitigation projects, and remediation activities which have been conducted to improve water quality in the Verde Watershed. Watershed partnerships active in this watershed are also described.

Total Maximum Daily Load Analyses – The following TMDL analyses have been completed or are ongoing in this watershed. Further information about the status of these investigations can be obtained by contacting the TMDL Program Manager at (602) 771-4468, or at ADEQ's web site: http://www.adeq.state.az.us/environ/water/assess/tmdl.html

- Oak Creek and Munds Creek Nutrient TMDL – The total nitrogen and total phosphorus Total Maximum Daily Load originally established in 1987 for Oak Creek was recalculated by ADEQ, at the community's request. This TMDL was extended to include Munds Creek, a tributary to Oak Creek on the 1998 303(d) List due to nutrients and bacterial contamination. The recalculated TMDL used more sophisticated simulation models that included allowances for non-point sources. It was approved by EPA in 1999.

  Oak Creek flows approximately 21 miles, with a 464 square mile drainage area, dropping 2500 feet through a steep walled canyon in the upper reaches to more gently rolling hills and plateaus in the lower reaches. Oak Creek and the West Fork of Oak Creek are classified as Unique Waters, subject to more stringent antidegradation protection and surface water standards. Munds Creek, one of several perennial tributaries to Oak Creek, does not share this Unique Waters status.

  The Total Maximum Daily Loads for nitrogen and phosphorus in the Oak Creek and Munds Creek are:

  < Total Nitrogen = 440 kilograms/day (67 from point sources, 365 from nonpoint sources, and 8 as a margin of safety)
  < Phosphorus TMDL = 58 kg/day (13 from point sources, 43 from nonpoint sources, and 2 as a margin of safety)

  The primary conclusions and recommendations included in the 1999 nutrient TMDL included:

  < Existing monitoring data and watershed simulation of conditions in the Oak Creek system over a five-year period suggest that few nutrient standards violations occur;
  < Modeling results do not indicate a need to alter existing NPDES permit discharge limits;
  < ADEQ interprets that the surface water quality Antidegradation Rule (R18-11-107) for Unique Waters (Oak Creek and West Fork of Oak Creek) to mean no new or additional loading sources for Oak Creek, nor for any tributaries if the tributary loads affect Oak Creek;
  < No new nutrient limits need to be set for septic system loadings (these were simulated as point source loadings due to modeling constraints); however, special studies of septic system efficiencies and recreational impacts should be conducted; and
  < Oak Creek's status as a Unique Water requires a comprehensive water quality and hydrologic monitoring program of sites on the creek, major tributaries, and major springs and other ground water sources. This also includes working with the Oak Creek Flood Warning System to improve its precipitation gage network and data management system. ADEQ does not have the resources to conduct this type of monitoring by itself and encourages stakeholders to coordinate with monitoring agencies and seek grants to pay for such monitoring.

- Slide Rock Pathogen TMDL – The swimming area in Slide Rock State Park on Oak Creek has experience seasonal exceedances of bacterial standards since the late 1960s. In 1996, the Arizona State Parks Service began daily testing of *Escherichia coli* at Slide Rock State Park to determine when standards are being exceeded and subsequently close the swimming area to protect the public health.

A study completed in 1998 by ADEQ established that a significant sediment reservoir of bacteria becomes suspended as a result of recreation pressure and storm events. No point sources discharge upstream of Slide Rock. Possible nonpoint source contributions include recreation, improper waste disposal, septic system seepage, and storm water runoff. Attempts were made to identify whether the bacteria were originally human, domestic animal, or wildlife through DNA genotyping.

Given the uncertainties inherent in the overwintering and regrowth phenomena of the bacteria and the relationship of sediment to water fecal coliform, a phase approach to load reductions is needed to meet standards. An implementation plan is being created to meet the following TMDL allocation:

< 30% reduction of sediment fecal coliform (i.e., reduction in summer sediment fecal coliform values to below 1,160,000 CFU/100 ml) , and
No exceedances of the single sample maximum *Escherichia coli* standard (580 CFU/100 ml) by 2002.

Or if *Escherichia coli* standard is not met by 2002, the TMDL automatically is amended to the same 30% reduction in sediment fecal coliform values and meet the single sample maximum standard by 2005.

Source reduction, coupled with Slide Rock State Park management practices are intended to ensure protection of public health at the park. The goal is to totally avoid swimming or full body contact exposure when *Escherichia coli* is at or above the single sample maximum.

- Pecks Lake pH and Dissolved Oxygen TMDL – A TMDL was completed by Tetra Tech, Inc. for ADEQ and approved by EPA in 2002. Pecks Lake, a 95 acre oxbow remnant of the Verde River, was impaired by two stressors: pH and dissolved oxygen. This TMDL focused on nutrient loading to Peck's Lake, as plant and algal productivity were tied to biological oxygen demand, availability of dissolved oxygen, and elevated pH. Nutrient loadings were also a concern as the area surrounding the lake is being developed as a residential area with 900 residences, a golf course, and commercial property.

The TMDL investigation showed that the occasional pH values that exceed the surface water standard and seasonal decreases in dissolved oxygen below the standard are primarily due to the effects of weed growth (macrophytes) on Peck's Lake water quality. At times macrophytes cover about 90 percent of the lake surface and play a major role in nutrient cycling and water quality processes in the lake. Internal nutrient cycling within the lake has resulted in the buildup and breakdown of aquatic vegetation resulting in dissolved oxygen, pH, and narrative nutrient standard violations.

TMDL allocations call for a "no net gain" in external nutrient loading to Peck's Lake. Internal nutrient loadings of both total phosphorus and total nitrogen need to be reduced 25% through harvesting of aquatic macrophytes and other methods. The Total Maximum Daily Load for nutrients were calculated to be:

Total Nitrogen – 74.4 pounds per day
Total Phosphorus – 11.15 pounds per day

This loading was distributed between the following sources, with an allocation reserved for margin of safety: natural background, development, and in-lake. If the existing passive flow through the lake is determined to not be sufficient during the first 5-year phase of this TMDL, additional aeration devises may be necessary.

TMDL implementation will include various strategies to minimize input from runoff and reduce internal nutrient cycling. A comprehensive and detailed monitoring plan has also been incorporated into the Storm Water Pollution Prevention Plan for the Verde Valley Ranch development.

- Stoneman Lake TMDLs – In 2000, EPA approved dissolved oxygen, pH, and narrative nutrient TMDLs on Stoneman Lake. The TMDL was completed by Malcolm Pirnie under contract with ADEQ. Stoneman

Lake is a 120-acre natural lake with a 900 acre watershed primarily of pine forest. A 70-home development is on the eastern side of the lake. The lake is relatively shallow (less than 10 feet deep), has no surface water outlet, and is designated as a cold water fishery. The lake has historically experienced an abundant growth of submerge aquatic vegetation during the warm weather months.

Generally a TMDL is allocated for critical hydrologic conditions. For Stoneman Lake this would be the lake going dry, as water quality in Stoneman lake will actually be best during wet years. Because of the impracticality of developing a TMDL for a dry lake, the TMDL was calculated for average hydrologic conditions. Within this context, the most critical season is the summer, with high temperatures and peak macrophyte growth.

The nutrient Total Maximum Daily Loads for Stoneman Lake were determined to be:

< Total Nitrogen – 2,057 grams per day (40% precipitation, 28% runoff and ground water recharge, 32% septic systems)
< Total Phosphorus – 676 grams per day (30% precipitation, 40% runoff/ground water recharge, 15% septic systems)

Dissolved oxygen standards should be met by the implementation of these nutrient loads as they are predicted to cause a 35% reduction in Biological Oxygen Demand over the growing season (from 11.9 to 7.7 mg/liter per day). Summer pH are also predicted to attain surface water quality standards based on the predicted 35% reduction in biomass density (from 410 to 258 grams of dry weight per cubic meter) with the implementation of this nutrient TMDL. Monitoring may demonstrate a need to create a site-specific seasonal pH criterion, as high natural pH is characteristic of shallow, high elevation lakes in Arizona.

The Stoneman Lake TMDL suggested and compared the costs and benefits of seven alternatives to bringing about the necessary reduction in loads. Of the seven alternatives, one is predicted to provide significant water quality benefits at a moderate cost: reopen a ditch to increase water flow into the lake by one-third, thereby helping to maintain higher average lake levels. However, reopening the CCC ditch will likely take 2-3 years, if it occurs. Meantime, increased monitoring will better define expectations for the system in the absence of the ditch water, and if the ditch cannot be reopened, this new data will be used to evaluate the need to set site-specific standards for pH, dissolved oxygen and narrative nutrients or revise designated uses.

• Verde River Turbidity TMDL – A turbidity TMDL for the Verde River was approved by EPA in May 2002. The Verde River is a perennial stream approximately 156 miles long. Three segments of the Verde River are listed as impaired due to turbidity in the upper section of this river between Perkinsville and Camp Verde.

A massive sampling effort was undertaken in October and December of 1999, collecting one hundred and eighty turbidity readings from above Perkinsville to Camp Verde. All turbidity values observed were below the 50 NTU Aquatic and Wildlife warm-water standard; however, these turbidity readings were taken during relatively low flows and not following a storm event. Natural levels for sediment are believed to be significant inputs into the Verde River, but have been accelerated due to anthropogenic influences.

Load allocations and reduction targets were identified in the TMDL. Turbidity impairment appears to be directly correlated to large storm events, and no load reduction is necessary during average base flow conditions (when exceedances do not occur). The Target Load Capacity for the Verde River during the critical storm flows was calculated to be 731,793 pounds per day as Total Suspended Solids (TSS), while the measured load was estimated to be 964,694 pounds per day as TSS. Therefore the Load Reduction necessary is the difference: 232,901 pounds per day as TSS.

A variety of Best Management Practices have been identified as part of the implementation plan to reduce sediment loading to the Verde River. Some of the implementation strategies include:

< Improve livestock management practices within the Verde Watershed.
< Designate off-highway vehicle areas and employ Best Management Practices at these sites. Enforce off-road travel regulations, educate the public, and close or obliterate unneeded roads.

- < Reduce impacts from dispersed recreation through implementation of the "Red Rock Passport," a comprehensive recreation plan for the Sedona area. Recreational opportunities have been limited on some heavily used areas to help reduce soil compaction and erosion from these activities.
- < Grassland restoration projects have been implemented to reduce pinyon and juniper densities and increase vegetative ground cover. This should increase infiltration and reduce soil erosion.
- < The US Forest Service, Verde Watershed Association, and Verde Natural Resources Conservation District continue to sponsor educational opportunities and public involvement in decisions regarding long-term management of this resource.
- < The US Forest Service, Verde River Greenway and the Nature Conservancy have been acquiring land adjacent to the Verde River through land exchanges and purchasing to reduce development in the active flood plain.
- < Prescribed fire treatments are being implemented to reduce adverse watershed effects from uncontrolled wildfire.
- < Maintenance and modifications to silted in water catchment structures (such as cattle tanks and Sullivan Lake Dam) will reduce the amounts of fine sediments being brought into the river system.

It may take at least 10 years to see the effectiveness of implemented TMDL strategies. US EPA recognizes that sediment TMDLs with primarily non-point sources of pollution can be difficult to manage, and that these problems have been created over generations and may require as long to correct.

- Beaver Creek and Wet Beaver Creek TMDL Studies – ADEQ collected samples and investigated potential sources of turbidity on Beaver and Wet Beaver creeks and low dissolved oxygen on Beaver Creek in 1999-2000. The low dissolved oxygen was determined to be naturally occurring due to ground water upwelling, as ground water naturally contains very low levels of dissolved oxygen. No turbidity exceedances occurred on Wet Beaver Creek out of 11 samples. Based on these investigations, ADEQ is recommending delisting Beaver Creek for low dissolved oxygen and Wet Beaver Creek for turbidity. However, the turbidity TMDL investigation of sources and loadings is ongoing in Beaver Creek. ADEQ is currently working with the US Forest Service to look at recent and potential improvements in rangeland and recreation management in this drainage area.

Draft Verde River Assimilative Capacity Data Summary Report – Significant population growth is projected for some portions of the Verde Watershed, and this growth will increase the nutrient loads from runoff, septic systems, and proposed new or expanded waste water discharges.

ADEQ contracted with Tetra Tech, Inc. to provide technical support for an assimilative capacity study. If the assimilative capacity of the river is anticipated to be exceeded with the addition of the proposed new point sources and secondary impacts from increased population, a Total Maximum Daily Load (TMDL) will need to be developed to allocate the available assimilative capacity and ensure that the river continues to support its designated uses. This data summary report catalogues, evaluates, and assesses the existing data and information about nutrient loadings in the Verde River. This will provide the information needed to select an appropriate water quality model. This report provides a summary of existing sources of data, standards, potential sources of nutrient loads in the watershed, a possible conceptual model, and remaining data gaps.

Water Quality Improvement Grants – ADEQ awarded the following Water Quality Improvement Grants in this watershed:

- Northern Arizona University On-site Wastewater Demonstration Project – This on-going project began in 1997. This project involves the construction of four different alternative on-site wastewater treatment technologies on the Norther Arizona University campus using married student housing wastewater effluent. The treatment options are linked to a system that controls operations and monitors and relays wastewater treatment parameters.

  The project utilizes the teaching and student staff of the Civil Engineering Department. Training for on-site professionals is conducted at the demonstration site and the teaching pavilion as well as at alternate locations such as Maricopa and Pima County. The project

will demonstrate the design and treatment options of site conditions typical to northern Arizona which are challenging situations of shallow clay soils over rock Research and product approval options are also available at the site.

- Oak Creek Pollution Prevention Project – The project addresses the bacterial contamination in Oak Creek that may be contributed by failing septic system (see prior discussion of Oak Creek's pathogen TMDL). In 1998, Coconino County received funds to partner with property owners and upgrade 8-10 existing failed or substandard on-site wastewater treatment systems along Oak Creek. The project will monitor and evaluate the performance of these installations for one year.

  The project also has a strong community education outreach component to increase the knowledge and cooperation of the public regarding on-site wastewater treatment and pollution prevention using a website, workshops, and formation of a Technical Advisory Committee for wastewater permitting issues.

- Northern Arizona University Oak Creek Sampling and *Escherichia coli* DNA Genotyping Project – Under the direction of the NAU Department of Environmental Microbiology, *Escherichia coli* samples were collected in water and sediment at five sites along Oak Creek Canyon. This study was designed to further characterize the existing bacterial problem in Oak Creek Canyon (see Slide Rock pathogen TMDL study above). Fecal material from potential mammal populations in the sub-watershed were also sampled to develop *Escherichia coli* genotypes. The report identifies the type and relative proportion of fecal pollution in Oak Creek, identifying contributions from human, cattle, dog, elk, deer, horse, mountain lion, racoon skunk beaver, antelope, bear and llama.

- Oak Creek Water Quality Guardian Project – This project is a cooperative effort with local property owners (homeowner associations), Coconino County Environmental Health Department and Groundwater Guardian affiliates to upgrade up to 10 old and potentially failing on-site septic systems from along high risk or susceptible area along Oak Creek. (See Oak Creek nutrient TMDL and Slide Rock pathogen TMDL described above.) The project principal, Canyon Services, has also mapped some of the areas' susceptible and challenging soil conditions. After upgrades are completed, the systems will be monitored for bacteria and phosphorus.

- Oak Creek Water Quality Guardian Sediment Project – In 1999, Circle C Engineering received funds to evaluate the effectiveness of using sediment traps in reducing bacterial pollution in Oak Creek (see Slide Rock pathogen TMDL). Erosion control sediment traps were placed at four strategic locations and monitored during storm events to provide data about transportation of fecal material in Oak Creek and the effectiveness of sediment traps. The project is a cooperative effort between Forest Service, State Parks, and citizens.

- Stoneman Lake Guardian Project – Circle C Engineering, a Groundwater Guardian affiliate, was awarded funds to upgrade septic systems, address grey water disposal, and provide sediment traps. A Groundwater Guardian newsletter was published to educate the public on the grant objectives and opportunities to participate in the seven septic upgrades and grey water systems. Monitoring for nitrate and orthophosphate will occur below the sediment traps and in washes and culverts during storm events to assess incoming loads to the lake. (See Stoneman Lake TMDL discussed above.)

- Cornville Watershed Project – A grant was awarded to the Yavapai County Flood Control District and local residents to revegetate a storm water detention pond using solar power to establish native grasses and shrubs to reduce sediment causing turbidity in Oak Creek. The project also used cattle to restabilize erosion gullies at the pond site. The site will be used for educational programs with local schools, and nearby Cornville Park. Workshops, educational materials, website and news releases are part of a strong community outreach component of this project.

Water Protection Fund Projects – The following projects received Water Protection Funds from the Arizona Department of Water Resources:

- Stable Isotope Assessment of Ground and Surface Water Interaction Between Chino Valley and the Verde River – Arizona State University

was awarded funds to sample surface and ground water in the Chino Valley, and to analyzed the waters for naturally occurring stable isotopes of hydrogen and oxygen. The main goal of the study was to determine if a hydraulic connection exists between the aquifers of the Chino Valley and the Verde River. This information would assist in determining the effects, if any, of ground water pumping within the Chino Valley on the flow in the upper Verde River. The study was completed in 1997.

- Sycamore Creek Riparian Management Area Project – The Tonto National Forest was funded to restore and protect a 19-mile reach of Sycamore Creek (a major tributary of the Verde River) from uncontrolled livestock grazing and off-road vehicle use. To stop further damage to the creek from uncontrolled livestock grazing and off-road vehicle use, 15 miles of fence were constructed to enclose the riparian corridor. The objective is to increase the canopy cover and density of riparian vegetation within the corridor. The project was completed in 1999.
- Road Reclamation to Improve Riparian Habitat Along the Hassayampa and Verde Rivers – The Prescott National Forest received a grant for a three-year project that should result in closure and revegetation of almost 20 miles of roads adjacent to the Hassayampa and Verde rivers. The goal of the project is to reduce erosion and sedimentation into the rivers, restore riparian and upland vegetation on the closed and reclaimed road surfaces, and eliminate unauthorized roads. The project was completed in 1999.

- Riparian Habitat Restoration Along a Perennial Reach of a Verde River Tributary – Northern Arizona University received funds for a three-year project to restore habitat critical to the successful regeneration of a Bebb willow-mixed graminoid riparian plant community. The project site is in the area of Hart Prairie (northwest of Flagstaff) on a tributary to Sycamore Creek. The project involves removing an existing surface water diversion, restoring the natural drainage channel, fencing critical areas, and monitoring vegetation response to hydrologic changes. The project was completed in 1999.

- Restoration of Fossil Creek Riparian Ecosystem – Rocky Mountain Research Station in Flagstaff was awarded a grant to determine the potential effects that a proposed reestablishment of part or all of the presently diverted flows of Fossil Creek could have on reestablishing riparian vegetation along the stream's corridor. The project was to compare and contrast historical vegetation with present vegetation to determine the consequences of adding additional water into the creek. The stream has been de-watered for almost 80 years by the diversions for hydroelectric use, but may receive some of all of this water within the next few years. The project was completed in 1999.

- Watson Woods Vegetation Inventory – The Prescott Creeks Preservation Association completed a vegetation inventory of Watson Woods in 1998. This inventory characterized the vegetative communities within the Watson Woods Preserve in order to describe baseline conditions at the site. This information will guide management and restoration efforts at the preserve.

- Upper Verde Adaptive Management Unit – The Almida Land and Cattle Company was awarded a Watershed Protection Grant to maintain the continued health of riparian habitat along the Verde River. The company is to develop a livestock grazing system that excludes cattle from replacement facilities uplands. To achieve this, the grantee will build six miles of four-strand barbed wire fencing, construct seven miles of underground pipeline, install twelve drinkers, and two 20,000 gallon storage tanks. The project is to be completed in 2002.

- Verde Riparian Action Plan – The Verde Natural Resources Conservation District (NRCD) was awarded a three-year grant to dig trenches and holes for planting cottonwood and willow trees along the Verde River and its perennial tributaries. Since 1991, the Verde NRCD has maintained a riparian species nursery and each year trees are harvested and sold or planted. This project will support the NRCD Riparian Species Planting Program efforts to restore riparian habitat of the Verde River.

- Horseshoe Allotment: Verde Riparian Project II – George and Sharon Yard, who ranch on U.S. Forest Service land along the Verde River, were awarded a Watershed Protection Grant to create an off-river pasture through development of a currently dry pasture. This goal is to

improve 3.75 miles of the Verde River by constructing pasture division fencing, river fencing, and a waterline for five cattle drinkers, three small wildlife drinkers, and two storage tanks. The project is to be completed in 2001.

- Upper Verde Valley Riparian Area Historical Analysis – Northern Arizona University (NAU) received funds to compare the historical riparian system of a seven-mile reach along the Verde River, with the current system to determine what changes have occurred in riparian vegetation. The grantee assessed the relationships between vegetation changes and climatic factors, human land use activities and varying ground water levels to determine which vegetation changes were caused by human activities in the watershed. Based on the results of this study, NAU made recommendations for preservation, restoration, and enhancement of riparian habitat. The project was completed in 2001.

- Verde River Headwaters Riparian Restoration Demonstration Project -- Northern Arizona University received funds to restore the channel and riparian vegetation along 2600 feet of a perennial stream that flows in Clover Springs Valley. The proposed restoration area is located in the Coconino National Forest about 5.5 miles south of Clint's Well on Highway 87. Specific project objectives include:
  - < Develop and implement a channel stabilization and wetland protection plan for the Clover Springs reach. This will include removal of existing channel structures, reshaping and redirecting the channel and use of low impact structures to encourage natural channel stability;
  - < Determine the causative factors and timing of aggradation and incision in this reach through investigation of past flood plain activity, radiocarbon dating and description of sediments, tree ring dating and historic photos;
  - < Develop an information kiosk or signs at the site to explain the role of meadow ecosystems, historic disturbances, current conditions, desired conditions, and restoration techniques.

- Effects of Livestock Use on Riparian Trees on the Verde River – Arizona State University is to study how various livestock use levels affect growth, survival and population dynamics of Goodding Willow and Fremont Cottonwood trees along the Verde River. Under the terms of a Biological Opinion for the Skeleton Ridge Allotment, no more that 40 percent of the meristems of these woody species may be used for grazing. This standard has been adopted by the Tonto National Forest for riparian areas with federally listed species. Anecdotal information supports this level of use but little quantitative data exists to support this standard. The project is to be completed in 2003.

Rocky Mountain Research Station Verde River Watershed Research – The US Forest Service Rocky Mountain Research Station has been conducting research in or adjacent to the Verde River Watershed since establishment of the Fort Valley Experimental Forest in 1908. Twenty drainage areas were instrumented with stream gauges, precipitation gages, and other equipment. Over 700 publications have been produced from the Beaver Creek Project alone. Since 1993, research has focused on the upper Verde River and Fossil Creek, looking at fish populations, riparian vegetation, water quality, and channel geomorphology. Some of their most recent reports include:

- A Preliminary Analysis of Riparian Habitat Conditions of the Upper Verde River (Medina, 2001) – Several vegetation and channel surveys were conducted in 1997, 1998, and 2000 in the upper Verde River. The study site is limited to the reach between Sullivan Dan and Tapco, the eastern boundary of the Chino Ranger District. The preliminary results of these studies are presented with special emphasis on stream bank herbaceous and woody vegetation and channel conditions that might influence spikedace. The plant communities described are those found on the streambanks and not totally inclusive of the entire riparian zone. Several influences capable of affecting the functional condition of riparian habitats are discussed including channel maintenance, exotic vegetation, grazing effects, and channel conditions.

- A Preliminary View of Water Quality Conditions of the Upper Verde River (Medina, 2001) – In 2000, two water quality monitoring stations were installed in the upper Verde River for the purpose of monitoring common parameters such as temperature, turbidity, conductivity, pH, dissolved oxygen, and suspended sediments. The preliminary results of one year of study are reported in this paper and contrasted with data from previous surveys.

- Base Flow Trends and Native Fish in the Upper Verde River (Neary and Rinne, 2001) – Although much attention has been given to the effects of storm flows on native fish in Arizona's rivers, the minimum base flows are the most critical for fish survival. Because of the controversy over threatened and endangered fish such as the spikedace (*Meda fulgida*) in the upper Verde River, it is important to examine the recent trends in minimum base flows on this river which supports a native fish community. Base flow and trends are reported.

- Role of Verde River Reservoirs on Water Quality: from Arsenic to Algae (Westerhoff et al., 2001) -- Variable climatic patterns and scheduling of reservoir releases along the Verde River impacts water quality in Horseshoe and Bartlett reservoirs, which serve as approximately one-third of the drinking water supply for the metropolitan Phoenix area. Data collected over the past five years along the Verde River from the confluence of Tangle Creek to the confluence with the Salt River was used to assess the impact of water quality in the Verde River on downstream potable drinking water facilities. The database includes arsenic, organic carbon, plus total and dissolved nitrogen and phosphorus in the Verde River and Bartlett Reservoir. In addition the database includes information on the algae occurrence in the reservoir, and the seasonal concentrations of algae-produced taste and odor compounds. This paper discusses how water quality in the Verde River impacts downstream potable water treatment plants in terms of meeting tightening drinking water regulations and providing water that does not have un-aesthetic tastes or odors.

Watershed Condition Assessment for Select Verde River 5th Code Watersheds – The Prescott National Forest assessed the watershed condition of lands from Big Chino Wash to Childs on the west side of the Verde River. The watershed assessment focused on three resource components: aquatic, riparian and soil conditions within the watershed, and related this information to designate critical habitat for spikedace (*Meda fulgida*) and loach minnow (*Rhinichthys cobitis*), two native threatened fish species. The aquatic assessment included information on water quality, macroinvertebrates, fisheries habitat, and geomorphology of the river.

Verde River Corridor Project – The Verde River Corridor Project began in the fall of 1989 as a locally directed effort, sponsored by the Arizona State Parks Stream and Wetland Program, with the goals of examining all the uses and values of the Verde River corridor. The study area covers the middle stretch of the Verde River which extends approximately 55 to 60 river miles, from TAPCO (north of Clarkdale) to Beasley Flat (south of Camp Verde). The mission of the project was to identify and recognize all uses of the Verde River corridor, encourage protection of the Verde River and its natural and cultural resources, and promote coordinated decision making for the continued enjoyment and use of the Verde River by future generations.

Ground Water Studies and Mitigation Projects

Prescott Active Management Area Baseline Study – The Prescott Active Management Area is 485 square miles, with the northern half in the Verde Watershed and the southern half in the Middle Gila Watershed. See discussion of this study in the Middle Gila Watershed section.

Federal and state Superfund cleanup sites – Three Superfund and Department of Defense cleanup sites are located in this watershed.

- Camp Navajo – Camp Navajo (previously Navajo Depot Activity), is a WQARF site located in Bellemont, Arizona, 12 miles west of Flagstaff and 17 miles east of Williams, Arizona. This 28,347 acres facility includes 776 igloo structures for storage of conventional (and formerly chemical) munitions. There is a demolition area in the southern portion and buffer zones along the eastern and western borders of the base. Contaminants of concern include heavy metals, volatile and semi-volatile organic compounds, pesticides, and constituents of explosives.

  The entire site is still in the remedial investigation phase, with ADEQ collecting soil, surface water, and ground water samples to determine the extent of contamination. The unexploded ordinance located on the surface of the open burning-open detonation range is of concern. ADEQ and the Army have agreed that surface clearance will be performed while the remedial investigation continues.

- Payson PCE site – In 1990, the discovery of tetrachloroethene (PCE), a solvent commonly used in dry-cleaning, in two unused Payson municipal wells caused the initial investigations at the WQARF site. ADEQ investigations found that PCE had impacted a number of

private wells in the immediate vicinity.

ADEQ and the town of Payson have taken precautions to prevent public exposure to the contamination. The Arizona Department of Health Services developed a "Statement of Risk" to identify risks associated with consumption of water from contaminated private wells in the area. Although most of the private wells were contaminated at levels below the drinking water standard established to protect human health (5 µg/L), well owners were advised to not drink the water and that ADEQ would provide a temporary supply of bottled water until the owners could secure an alternative supply. Continuing tests indicate that the town of Payson municipal water supply has not been affected by the PCE.

- Tonto and Cherry Streets in Payson site – The Tonto and Cherry WQARF site in Payson is 400 feet west of the Beeline Highway and immediately north of Frontier Street. Tetrachloroethene (PCE) has been detected in three private drinking water and three ground water monitoring wells at the site. PCE concentrations in the private wells exceed the drinking water standard; therefore, bottled drinking water is being provided to these private well owners on a temporary basis. A fact sheet was mailed to all of the residents and businesses within the community involvement area and in December 2000, the Tonto and Cherry community advisory board (CAB) combined with the existing Payson PCE Community Advisory Board.

  In February 2001, ADEQ completed the installation of three ground water monitoring wells near Tonto and Cherry Streets. Due to ground water information obtained during drilling and sampling, ADEQ decided not to install extraction wells at Tonto and Cherry at this time. However, ADEQ will continue to conduct monthly ground water measurements and quarterly ground water quality sampling at the site.

Watershed Partnerships

Verde Watershed Association -- The Verde Watershed Association was formally organized in 1993. The association is made up of concerned citizens from the community, users of the Verde watershed resources, and local, state and federal agencies. Members identified key issues, and are identifying sources of water and the real and potential threats of pollution to these waters. In addition, the association has initiated and or participated in programs to remedy these concerns. It is important to understand that this is a locally led effort with the role of federal and state governments being that of administrative assistance and technical support. The group meets monthly in Cottonwood, Arizona.

The Verde Watershed Association publishes the monthly newsletter *Verde Currents* (formerly *Confluence*) which is available on its website. The association has developed a Watershed Restoration Action Strategy which is also available on their website: http://www.vwa.southwest-water.org

Oak Creek Task Force – The Oak Creek Task Force is an organization of agencies and concerned citizens. Agencies actively involved in the Oak Creek Task force are: Arizona State Parks, US Forest Service, City of Sedona, Arizona Department of Water Resources, Northern Arizona University, Coconino County and Arizona Department of Environmental Quality. The group is actively involved in grant projects and public outreach to maintain and protect the Unique Water status of the beautiful and very popular Oak Creek Canyon. The Task Force has a draft Watershed-based Plan targeted to be finalized in fall of 2001. Information about meetings can be obtained from Co-chairmen: Barry Allan, (602) 953-1291 and Morgan Stine, (520) 282-1101.

Verde River Alliance – This citizen initiative advocacy group is in its formative stages following workshops developed with the assistance of the Nature Conservancy. As of this writing, the group has a newly elected steering committee of six members and draft mission statement and objectives. Information about this group's activities can be obtained at the following e-mail address vrca@verdenet.com.